

THE EASTERN REVIEW

FINANCE ENGINEERING COMMERCE



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PROPOSED TRAIN FERRY SCHEMES

THE UJIKAWA ELECTRIC COMPANY

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Greensburg, Pennsylvania,

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Mr. George Bronson Rea,

The Far Eastern Review, Shanghai, China.

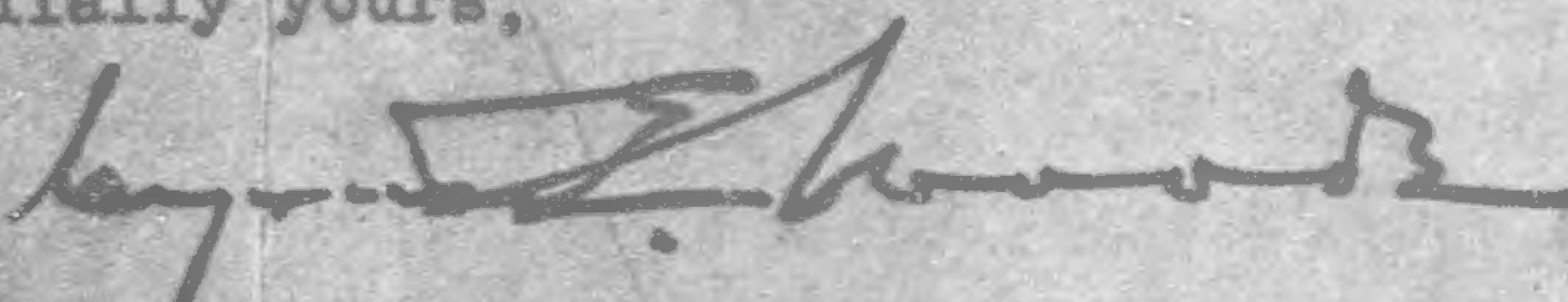
My dear Mr. Rea:

Many, many congratulations on the splendid work you have done in The Re-construction Number of the Far Eastern Review.

It shows in a most satisfactory way not only what Japan has already accomplished in rehabilitating the devastated area, but it also shows the wonderful work she has in progress and has planned for the future. Furthermore, the re-construction budget indicates that Japan has both the ability and the willingness to accomplish the desired result.

Once again I take great pride in my Japanese friends.

Cordially yours,



Cyrus E. Woods.

The Far Eastern Review

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No. 11

Shall Japan Lead the Powers in China?

Japan's Leadership at the Tariff Conference an Acknowledgement of Japan's Pre-eminence in China's Trade

Meeting China More than Half Way but What Will it Avail?

THE Tariff Conference may not reach any conclusion. The delegates are already meeting under fire of contending forces. Feng Yu-hsiang is marching his troops beyond Peking toward Tientsin and in another direction toward Mukden. Chang Tso-lin is sending reinforcements and armaments beyond the Great Wall into China. The delegates who have come to China in all sincerity and friendship, who have sought to help the Chinese people in their transitional period, who have listened to the extreme demands made by China's delegates and have conceded point after point, find themselves with a Chinese Government which is now representative of nothing in China and should the civil war take on a phase which might endanger the persons of the Government now in power and of the Chinese delegates now negotiating, there would surely be an exodus to the foreign concessions in Tientsin. The foreign delegates would one day arrive at the Conference but find no Chinese delegation. They would find that there is no Chinese Government. They would find themselves attending what some one described as Simian Business.

China's Constant Chaos

For years the Powers have been weary of the trouble that is made for them by China. It is not that serious-minded men would continue indefinitely and unchanged the present position of the foreigners in China. It is not that the Powers are unwilling to grant China autonomy and equality. It is rather that the Powers find in the lack of government and stability in China a dangerous spot on the earth's surface which may at any time bring about a world-wide cataclysm. Nobody can altogether disregard the fact that due to China's lack of governmental control of the frontiers, Russia has since 1919 marched into Mongolia and Turkestan and practically organized both into largely independent republics. Nobody can disregard the dangers to world peace in Russia's position in Canton, where a Russian agent, Comrade Borodin, is practically a Czar, who utilizes his power to destroy the business of other nations—nations which are not unfriendly to China but against whom Russia bears an ancient grudge. No nation can disregard the fact that Soviet Russia is utilizing the situation in China to turn this country into a buffer state as between Russia and Japan on one side, and Russia and Britain on the other. Furthermore, nations which at present have no predatory designs on China, nations which hope and desire only to help China and to recognize her equality in the family of nations, find themselves subjected to boycotts and strikes which are financed by Russia, instigated by Russia and from which only Russia derives benefits. Every nation has got to recognize that in this situation, the Bolshevik government is seeking to utilize China as a base for the destruction of British, American and Japanese industrial life that the great foreign trade of these countries might cease and that the workers, who

must depend upon foreign trade for labor, might be forced by hunger and discontent to create disturbances in their own countries. That is Russia's aim and China is only a tool.

The disappointment of the Powers, therefore, that so little has been and can be accomplished at the Tariff Conference is very great. They feel that they have done their best and that China is unable by internal conditions and by the promptings of her false friend, Russia, to set her house in order or to utilize the assistance offered by the Powers to set her house in order. After all that has been happening since the Versailles Conference, the Powers are naturally at their wits' end to know what to do about China. If they altogether disregarded China, withdrew their missions and settled down in the Treaty Ports, Russia will utilize such a situation to create disturbances throughout Asia, for Russia stoops to methods which to any other nation would appear to be not only reprehensible but beyond the bounds of ordinary decency. If the Powers intervene in China, they realize that there is not sufficient *esprit de corps* amongst themselves to make co-operation long-lasting. Their only hope lay in agreeing to the leadership of one of the Powers and the granting to that Power of the support necessary to make the task successful.

Mr. Hioki's Leadership

That was done at the opening of the Tariff Conference. The principal speech at that opening session was made by Mr. Hioki, the Japanese delegate. In that opening speech he read China a lesson, as an older brother speaks to a younger. He told China of Japan's efforts to gain equality and how successful but slow they were. He indicated that if China would follow a similar path there was reason to believe that ultimately China would succeed as Japan succeeded. He indicated that the path of success lay in the general direction of internal reconstruction and that it was hopeless to expect that success could be achieved on the basis of internal chaos and international impertinence. His address was a masterpiece of plain speaking in international relations and will rank with Mr. Hughes' statement at the opening of the Washington Conference. The other speeches, in effect, seconded what Mr. Hioki had said. They made it clear to China that they came in friendship and hoped that China would find a way toward the establishment of order and Government so that friendship might result in something tangible. And while they meet, before they have a chance to settle their terms, before a new treaty is written or the old ones amended, China is again thrown into the chaos of civil war, the armies of the various generals again march through the country bringing destruction in their wake, the government is again about to be changed, the chief executive is practically made a prisoner and everything sane and sensible gives way to the horrors and childishness of the militarists' annual game of driving one another about the country.

Russians in all Armies

The presence of Russians in several of the armies, on both sides is ominous. Were Englishmen or Americans or Japanese to be used by the various tuchuns to fill the ranks of their divisions, there would be an outcry in China of foreign interference and the Soviet Government would organize a "Hands-Off-China" Movement not only in their own country but in others, particularly in the United States, where rich and sentimental women get a tremendous kick out of interfering with things they understand nothing about. But, to Chinese and to many foreigners the Russians are regarded as refugees who are willing to act as mercenaries for their daily bread. That is all sheer ignorance. The Russian mercenaries in all the armies are working for the Soviet Government. They win forgiveness for a previous state of "whiteness" by fighting in China, by creating disorders in China. Soviet agents have approached all sides of the present conflict and have offered them assistance asking no promises in return. Only the truly patriotic and suspicious generals have refused their advances, because they realized that when someone offers something for nothing, there is a trick in it. *The trick is that Russia wants disorders in China. Russia wants the fight. Russia wants China to be in chaos. For as long as China is in chaos, Russia can continue the process of stealing Mongolia and Turkestan, Russia can continue her penetration in northern Manchuria. That is not all. Russia wants chaos, because it interferes with foreign trade and therefore lessens the interest of the westerners in China.* It is a long and dangerous game that Russia is playing and one that can have no end other than a war for the extermination of Russia's influence in Asia.

Shall Japan lead in such an enterprise? It is inevitable that Japan shall view with distrust and alarm Russia's movements in Mongolia. It is inevitable that Japan shall object to Russia's advances into Manchuria. One need only study the history of the two countries, to understand what their national ambitions are and to watch their economic development, to realize that Japan is dependent upon Manchuria and Mongolia for her life. There was a time when the European Powers were suspicious of Japan. There was a time when the United States distrusted Japan. That time is over except in the minds of picayune individuals which live in an atmosphere of racial hatreds. **Japan has met her obligations, has lived up to her treaty contracts and has worked valiantly with the western Powers for the maintenance of the peace of the Pacific and the western Powers will not forget it.** As between Russia and Japan, the Powers will never support the Soviet Government against a people who are orderly, peace-loving, law-abiding, who have paid their way as they have gone and whose constructive genius has won the admiration of the world. The Powers will back Japan. Particularly will the United States and Great Britain back Japan because they feel that in their own countries they have to recognize the racial situation and that therefore it is advantageous to them as well as to Japan, that Japan should have freedom for economic development in the underdeveloped countries of Asia, Manchuria and Mongolia. Furthermore from

a trader's standpoint, the United States and Great Britain have always benefitted from Japan's exploitations because wherever Nippon has gone, railroads, roads, mills, factories, industries have gone and the machinery and steel for these enterprises come from the United States and Great Britain. The South Manchuria Railway alone buys more steel in the United States than the rest of China put together. That is a fact which is not to be forgotten. And because of such facts the Powers will back Japan.

What Will China Do?

Will China recognize that Japan has a right to fight for her life and that it is not to the interests of China that the wonderful developments of Manchuria should fall into the hands of Soviet Russia? Much depends on China's attitude. If China is fatuous enough to believe that by allowing Russia to continue the present policy and by bending to that policy, the western Powers will be brought to their knees, it simply means that China has lost all sense of statesmanship. If, in the event that Japan has to fight for her life again in Manchuria, China provides an unfriendly rear, things might go very hard on China, for as the world is constituted these days, nations do not allow their rears to be endangered during periods of warfare and they take no chances because of sentimental considerations. China's only hope lies in supporting such a situation as will guarantee the integrity of the frontiers, that is, that Manchuria, Mongolia and Turkestan shall remain integral parts of the Republic of China. Japan would be more than ready to fight for just that principle. Great Britain would be more than ready to fight for that principle. The United States would support the Powers which were fighting for that principle. Therein lies China's path and China's strength.

The American Attitude

If Japan is to assume the leadership in the fight against Soviet Russia, the other Powers which are suffering in China because of Russian activity will have to recognize that leadership and will have to lend to Japan every possible assistance. There can be no question as to the American attitude. It is not generally recognized that as sentimental as the United States is about China, the United States is more sentimental about Soviet Russia but in a different way. The United States simply despises Soviet Russia. The United States is the last Power which refuses to recognize Soviet Russia. American labor is as much opposed to Bolshevism as American capital. Any nation which takes up the cudgels against Russia will have American support, not only support of the Government but the more solid support of the American people. The American people will enjoy the spectacle of little Japan defeating the Great Russian Bear as Japan has already defeated that country. The American people will look to China to do her share in achieving that defeat, as a recompense for all that America has done for China. For the American people will realize perhaps only soon enough that only Japan stands between them and Soviet Russia, between them and a Russified East Asia.

Do the Chinese Hate the Japanese?

MR. ARTHUR BRISBANE, the erudite editor of the Hearst publications, the brilliant son of a liberal father, a man who should know better, continues to sing his songs of hate. He hates the British and he hates the Japanese. He lives and thrives upon these hatreds. They are to him the foundation of his intellectual life. His religion seems to be based upon this sort of hatred.

Under the caption "Today" Mr. Brisbane places the sub-head "Kill British, Japanese." Then runs a little paragraph which is as ill-timed as it is motivated by hatred, as mischievous as it is untrue. He says:

A little cloud, about the size of a monoplane wing, shows in the east. Chinese students were parading Peking's streets yesterday afternoon, denouncing the killing of strikers in Shanghai,

seeking to enter foreign legations and yelling 'kill the British and Japanese.'

"That last is the reassuring word, Chinese hate the Japanese most, British next, Germans perhaps next. They don't hate us very much. And most of all, they hate Japanese."

"From the western white man's point of view, that's the reassuring thing in Asia. The Asiatic always hates some other Asiatic worse than he hates any European. A really high spirited Mohammedan in India would rather kill three Hindustanis than one Briton any day."

But who says that the Chinese hate the Japanese most of all? Who says that the Chinese hate at all? Except for the Boxer trouble, which was as much anti-Chinese as it was anti-foreign, which was a political move on the part of an alien dynasty to prevent

themselves from being forced into constitutionalism, the Chinese have never shown any indication of hatred against foreigners. The Student Movement of 1919 was definitely not anti-foreign but anti-governmental. The Chinese simply objected to the signing of the Versailles Treaty. In the course of that movement Japan and Japanese goods were boycotted because Japan held Shantung, but the moment Japan returned Shantung and the Japanese policy toward China changed, the Chinese attitude toward Japan changed. It will surprise Mr. Brisbane and others who study conditions in China from scant telegraphic newspaper reports that in the Sino-Japanese friendship association in Shanghai are included as active members men who were most diligent in propagating the anti-Japanese boycott in 1919. They are today pro-Japanese, if anything. They realize that China's safety lies not in chauvinism or in playing with Soviet Russia but in friendship with a powerful and closely related neighbor.

In the present upheaval, Japan has suffered less than Great Britain not because the Chinese hate the Britons more than the Japanese or more than the Americans, but because the controlling nation in the Shanghai Municipal Council, which is international and the chairman of which is an American, happens to be Great Britain, because of the preponderance of British interests in the city. Had the same incident occurred in a city where American or German interests predominated, the attack would have been on the United States or Germany. Some day the Chinese are going to turn on Soviet Russia on account of the Chinese Eastern Railway and the Mongolian situation. Some day they are going to turn on France because of French machination in Yunnan. They will then not hate Russia or France. They will be expressing an opinion after their own fashion on current events. In a country where there is no ballot, no orderly method of expressing public opinion, the people naturally turn to mob expression. That is the easiest way.

The test of friendship is trade. In regard to trade the predominance is with Great Britain and Japan. Japan's trade is constantly growing. The number of Japanese banks in a city like Shanghai is on the constant increase. The relationship between Chinese firms and Japanese firms is friendly. For instance, when the Chinese textile industry found itself in difficulties it turned to Japan for assistance. At first it looked to the manufacturers of the machinery used, American firms, for relief, but the Americans were unable to do anything for them. The Americans were unable to provide them with the loans to pass over a hard period. They went to the Japanese and found the money they needed. Similarly in other industries, the business men of China have found that the business men of Japan mean business. Confidence and friendship are built in that way, not by talk.

The position of Japan in China is a very difficult one because of propinquity and the disorders within China. It is natural that moments of misunderstanding and antagonism should arise, just as Mexico, from time to time, misunderstands the United States and as a Canadian newspaper objected to the crossword puzzle explanation that the United States was the greatest nation on earth. Neighbors and relatives are more likely to misunderstand each other than strangers who meet occasionally and always put their best manners forward. But the future of China and Japan are so interwoven, particularly because of Japan's commercial and economic interest in China and Manchuria that it is fatuous to assume that the people of the two countries can hate each other. Men who read the same language, who are bred to the same philosophy of life, who love the same art, whose food is similar and whose table-manners are the same, men whose every phase of life is similar cannot hate each other. They may quarrel but they can never hate.

Mr. Brisbane's suggestion that the white man can find safety in the Pacific if the Chinese hate the Japanese is another indication of a misreading of Far Eastern affairs. Were the Chinese to hate the Japanese, they would still not love the white man more than they do. After all, the American exclusion of Chinese, even of Chinese merchants and tourists under the new immigration acts, is something which every Chinese views with shame and stronger feeling. The fact that a Chinese woman married to an American cannot become an American citizen under any circumstances, that she cannot even live in the country of her husband for more than a statutory period, cannot be regarded as an act of friendship by Chinese. The fact that the very legislation of Congress against orientals indicates to the oriental that the American Government regards them as inferior, as races lower than the mixed peoples of the Bal-

kans, than the wild races of South America, is not a pleasant thought for a Chinese who ranks his culture as equal if not superior to that of many European nations. Friendship is not erected upon prohibitions and exclusions. There must be affection. There must be faith.

Should the war for which Mr. Brisbane apparently hopes between the United States and Japan ever take place, Americans living in the Far East would be sorry indeed. For after all, our growing trade depends upon peace and to a large extent upon peace with Japan. The United States sells more goods annually to Japan than China. The United States probably sells more American goods in China through Japanese and British firms than through American firms. It is all grist to the national mill however the goods are sold and those Americans who at one time thought that the only safe way of doing merchandizing business in the Far East was through local American firms have gradually come to change their minds. The way to do business anywhere is to do it as it can be done. If American goods can be sold by an American, British or Japanese firm, let it be sold by whoever can place the order.

The principal American industry in China is the missionary work, which employs the largest number of Americans in the country and involves the largest American investment here. The missionary cannot thrive on disturbances. He requires peace and a friendly attitude. In 1919 the American missionary made the singular mistake of encouraging his students to be unfriendly to Japan because of the Shantung question. The result has been that every time the students are dissatisfied with something the Americans do, they attempt to follow the same procedure that they did in those days. In a word, the missionary stirred up trouble for himself when he countenanced any form of anti-foreignism. When Mr. Brisbane suggests hatred for the Japanese, he is encouraging a form of chauvinism which is bound to react detrimentally to all foreigners in China, including the Americans.

Mr. Brisbane has a great reputation in the United States and men listen to his words of wisdom because he is reputed to obtain a huge salary for writing them. But his purview of the Far Eastern situation is not wisdom because it comes out of his own head without specialized knowledge and without any experience. Mr. Brisbane has not within recent years visited any Far Eastern countries and he has not viewed for himself conditions here. For instance the last paragraph of his statement is so false as to contradict all that has happened in Asia since the Great War. Mr. Brisbane knows nothing about China, Japan or India. He might speak less like a prophet on a mountain and more like a man of affairs if he saw the situation first hand.—G.E.S.

Japanese Railways Adopt Automatic Couplings

A few years after the nationalisation of railways in Japan, it was decided that steps should be taken to equip the whole of the rolling-stock with automatic couplings. To the end, considerable preparatory work was done in three stages, and on July 17, last some 63,000 vehicles were finally equipped and ready for service with automatic couplings, the actual work of transition being performed in the course of a single day. The amount expended represents the sum of Y.26,900,000 while the Government has also paid some Y.1,500,000 yearly to the private railway companies as a subsidy of half their expenditure in converting their stock of 5,000 vehicles. Prior to the recent change over, automatic couplings were in use on the railways of Taiwan (Formosa), Chosen (Korea) and South Manchuria, these railways being under Japanese jurisdiction, while in Japan proper they had only been in use on the Hokkaido lines of 1,300 miles and on the Tokyo suburban tramway lines. In order to effect the change in such a short space of time, freight traffic movement over the whole of the Japanese railway system was completely stopped, with the exception of a few "perishable" specials, for an entire day, and the vehicles were gathered at 221 stations. There gangs of men were assigned to replace the couplers, from 20 to 25 cars being allocated to each gang, or approximately 3.5 vehicles to each workman. In all, 12,000 men were engaged on the work. It was anticipated that the work would require the whole day, but at many places the transition was accomplished in half that time. As a result, all the stock on the Japanese railways is now completely equipped with automatic couplings, and it is anticipated that, among other advantages, coupling and uncoupling accidents, which have averaged about 220 per year for the last five years, will be greatly diminished.

When is Co-operation Not Co-operation

Since the Versailles Conference and the Organization of the Consortium the Powers have Sought to find Common Working Basis in China.

The Wireless Situation an Unnecessary Stumbling Block

IF the Powers are able to co-operate on such questions as financing Government loans or building railroads, why is it so difficult for them to co-operate on the building of wireless stations in China? The wireless tangle, which for six years, has kept the Chinese Government and the various Foreign Offices wondering how it would all end, is a mess which could not have happened had there been a well organized, orderly Government in China. The difficulty arose because each Cabinet Department seems to go off altogether on its own in the making of contracts. In 1913, an agreement was made with the Marconi people for the erection of wireless plants which led to nothing because of the Great War; in 1918, a contract was entered into which gave the Mitsui Company the work of erecting stations in China; in 1921, a contract was entered into with the Federal Wireless Company of America to erect a plant near Shanghai. The Mitsui Company has actually erected a wireless station outside of Peking which is now ready for occupation. Neither the British nor the American contracts have ever been consummated in any form. The Japanese therefore have a claim that their contract is not only bona fide but has actually been consummated; they have actually gone ahead with their work and have accomplished something while the American representatives have sat in Peking negotiating and talking and getting nowhere.

Building Without Contract

There is a justifiable doubt as to whether all this wireless talk is really worth while. There is a question in the minds of many as to whether China requires all the wireless stations which are planned to be erected. From the standpoint of China's narrower interests, the plants need not be erected at this time, but the progress of the world moves on unarrested and when a nation does not do things for herself, someone else generally steps in and does them. Wireless stations have been erected in many parts of China to which the Chinese Government at some time will undoubtedly take exception. The American Legation station in Peking, the French station in Yunnan, the wireless equipment of the Fengtien army are all matters about which the Government of China has had little to say, and as long as there is a world need for wireless communications with China, stations will come into existence. It is therefore to the greatest interest of the Chinese Government that these stations should in some way be under its control, even if that control is limited because of the poverty and incapacity of the present Chinese Government.

A Wireless Consortium

The Japanese contract is for 30 years. It stands on its terms plus the fact of accomplishment. The American contract and the methods thus far employed would give the impression of a dog-in-the-manger attitude: if we can't go ahead with the thing, we won't let anyone else do it. The British contract is in effect an option. The French have gone ahead with a plant in Yunnanfu without any contract with the Chinese Government. Thus we have four nations struggling over the control of China's wireless. But why should there be any struggle? Why should the foreign nations not work together in this matter? The Open Door Policy cannot mean the right of the United States Government to object to other Powers monopolizing certain concessions in China and then seeking a monopoly for herself. Only a limited amount of business can be done over the wireless from and to China. The Japanese plant outside of Peking is bound to get a certain share of that business. If the Americans build a plant near Shanghai they are bound to get a certain share, but neither plant will be profitable, particularly if they are managed on a competitive basis. It stands to reason that the same arguments which apply in favor of the Consortium apply in favor of a wireless consortium, with of a definite Chinese interest. If the advantages of non-competition apply to

government finance and railway building, those same advantages appear when the question of wireless arises. The logic of the situation then is with a wireless consortium and it is difficult to understand the American opposition thereto.

The Chinese Government has apparently approached the American and Japanese Governments with a proposal to merge their contracts and to join with China in a joint building and control of wireless stations in China. It is to be presumed that once an agreement is reached between these principals in the matter of wireless contracts, other countries which have build or which control plants or which have contracts of some sort will be included in the wireless consortium so that the matter is settled satisfactorily to all parties concerned and to the general benefit of China, which is after all the principal consideration in the business. The Japanese seem to take kindly to the suggestion in spite of the fact that they have an enforceable, iron-clad agreement and a plant which is ready to begin operations while everybody else is still talking. The American Government however is taking a rather dangerous view of the situation. They want the Federal Wireless Contract to be gone through with before they will discuss amalgamation. They say that is a part of the Open Door Policy. They say that an agreement must be completed before they will consider any other questions. All that is very fine, but when a Power becomes unreasonable in her attitude, it becomes difficult at times to business with her, and with the situation as it is at present in the Pacific, with Russia intriguing against all the Powers with equal venom, it is not wise nor advantageous to take an unreasonable attitude. It is the sort of stuff that makes for unfriendliness on greater issues.

China's Terms

The terms suggested by China, as reported in the press are as follows:

1. By means of a new loan from both Japanese and America a large wireless station shall be established in China, and its management shall be entrusted to the three Powers, viz., Japan, America and China.
2. The Japanese wireless station at Shuangchiao, China, shall be made a branch of a new station to be constructed.
3. Details of this plan shall be discussed at a joint conference of the three Powers.
4. The fund raised through the loan shall be principally spent for the erection of the wireless station.
5. Regarding the expenditure of the new loan, commissioners shall be appointed by both Japan and America to supervise it.
6. In order to insure good management and maintenance in the future of the wireless station to be constructed, the business shall be subject to close inspection.
7. The personnel and other matters affecting China's sovereignty shall be entrusted to China.
8. As the security for the loan, the income from the new station shall be offered.
9. Regarding other details, they shall be discussed at a joint conference of the three Powers."

If the American attitude is simply based upon the question of the sanctity of agreements, the question might well be asked why the State Department allowed an American company to enter into an agreement knowing that another already existed covering the field. If it is a question of the Open Door Policy, then why not follow the consortium idea? It is sometimes difficult to follow the mental peregrinations of diplomatists and foreign office officials, but it would appear that there is little sincerity behind the suggestion that the motive for opposition to joint action is the sanctity of agreements or the Open Door Policy. It would appear that there is some deeper motive, some sinister intention to utilize the wireless not in China's interests but to serve the nation erecting the station.

The time is past for that sort of thing in China and nationals of all countries in China oppose the utilization of concessions in that way. That is the sort of thing which has proved so fatal in the past and is responsible for most of the troubles between China and the foreign Powers at the present time.

The War Scare and the Wireless

It would appear that there is an element in the United States which is still somewhat madly following the theory that the day will come when the United States must fight Japan. This element is found at its worst in army and navy circles. It is found in its least significant form in business circles, for the business man understands and places his money behind the assertion that war between the United States and Japan is literal bunk. The army and navy men must always have a bogey. They have got to scare the public to get appropriations through Congress. They therefore keep this anti-Japanese feeling alive and the wireless scheme fits into their propaganda most effectively. They want an American owned and American controlled wireless station in China so that in the event of a war, their communications would be complete. In the development of their theory they altogether disregard the rights of China in the matter. It does not occur to them that in the event of such a war, China might for instance desire to be neutral, in which case such a wireless plant might get China into trouble with Japan. Nor does the possibility suggest itself to them that China might even join Japan, which is always a possibility, and seize the plant either

for warlike purposes or to dismantle it. In a word, in attempting to see too far ahead, these gentlemen fail to take into consideration all the possibilities and probabilities of the situation. They have simply hypnotized themselves into following an idea and they fight for it, right or wrong.

If the United States is sincere in her desire to help China at all times, a suggestion which one is constantly hearing with regard to Sino-American relations, then the best way to help China out of the wireless mess is to join into the wireless consortium. If the United States is unwilling to follow such a procedure and insists upon China's living up to untenable agreements, then it will be found that China will be forced to follow more keenly her own interests. And at the present time, it will be easier for China to sacrifice the goodwill of the Federal Wireless Company than the goodwill of Japan or of the Mitsui Company. The relations between China and Japan, between the Chinese Government and the Japanese Government, between Chinese merchants and Japanese merchants are closer and of greater importance than China's relations with the United States, which are largely sentimental and intangible. If the United States wants to apply a practical demonstration of the value of this sentimental friendship by getting China out of a hole of her own digging, then here is a way to do it. And in the end the United States will benefit, for what America wants in the Far East is to build up goodwill, friendship, a fine feeling, a sense of dependence upon fair play, so that when the days comes when it is necessary to drive the Bear out of the Pacific, China and Japan will be with the Nations of the West rather than with the Bolsheviks of the North.

The New Asia

By F. R. Eldridge, Chief, Far Eastern Division, U.S. Department of Commerce

AN economic transformation is taking place in the Far East. It forms the basis and furnishes the cause of the social and political changes so manifest on every side. Evidences of this change are everywhere in the Orient to-day, and the new Asia of to-morrow will be as different from the Asia of yesterday as the New World of the Western Hemisphere is from the Old.

The war hastened and accentuated this economic change, but its first causes go farther back than 1914. Its inception was in the sixteenth century, when the first western contacts with the older civilizations of Asia began to revolutionize far eastern thought. Japan ultimately accepted and adopted western civilization; China, until lately, resisted it; and the tropical peoples of Malaya, India, the Philippines, and the Dutch East Indies succumbed to it after a brief struggle.

Japan

Modern industrialism in Japan dates from the expiration of the original Franco-Japanese commercial treaty in 1911. Although most other nations had formally revised their treaties and granted Japan tariff autonomy some years earlier, the application of the most-favored-nation clause in their treaties gave them the same benefits as accrued to France until the French treaty expired. From that time on Japanese industry strove to supply domestic wants from domestic sources, and a policy of economic self-sufficiency has since been steadily pursued.

Lacking in coal, Japan has made remarkable progress in hydroelectric development; having no iron ore, 80 per cent. of China's iron resources have come under Japanese control. Home production of the wool and raw cotton needed in Japan's new textile industry being impossible, Australia and the United States have become steady sources of supply for these.

The abundance of copper in Japan and the presence of plentiful hydroelectric energy have made the electrical industry one of the most promising developments, while cheap and ample sulphur and wood have formed the basis of an encouraging match industry.

The glass and paper industries were also favored by a good supply of raw material.

Need for Standardization

As in Europe, these activities began in Japan as household industries. Some of them grew rapidly under Government bounty and support, notably the iron and steel industry during the war, which still has as its basis the needs of the Japanese Navy and merchant marine. The textile industry soon became established on a modern factory basis. Before many industries had emerged from the household stage, however, the war cut off the markets of the South Seas and India from their accustomed supplies of European and American manufactured goods. Japan saw an opportunity to sell textiles, glassware, hardware and utensils, paper, and other products and without waiting to modernize its industrial establishments began to expand its sales abroad.

The difficulty of producing under the household system a standardized article for the huge foreign trade which now developed was soon apparent. Government measures were devised for inspecting articles for export and holding them to certain standards. With several parts of a large order being filled in half a dozen small factories, however, it was obviously impossible to achieve complete standardization. The permanence of the new markets for Japanese goods was, therefore, considerably affected, and as soon as Europe was in position to enter its lost fields Japan suffered a serious curtailment in the export trade of its newly expanded industries. This was one of the principal causes of the slump which took place in May, 1920, in Japan and carried in its trail a price deflation and depression of serious consequence.

Through a series of heroic Government measures, including the formation of the silk pool and the "Wednesday Association" of copper producers, Japan's basic industries were saved from utter demoralization. Market prices are now well above cost of production and are more or less stable. Japanese manufacturers have learned a lesson, however, and a general movement toward amalgamation and concentration in industry is under way.

It is already evident that many of the industries founded on war demands cannot survive even under amalgamation and protection, because of the lack of raw materials, suitable labor, or a market extensive enough to make large-scale production profitable. As a result we may witness a concentrated movement to build up strong units in such industries as electrical supplies, cotton textiles (depending more and more on Korean and Chinese raw cotton), silk textiles of the cheaper grades, certain chemical industries (particularly the electrochemical group), certain types of paper of the better grades, matches, toys, and cheaper glassware, and an abandonment of more ambitious projects in the iron and steel, machinery automotive, railway equipment, and similar fields, except such Government mills and workshops as are deemed necessary for national welfare.

China

The movement begun early in the sixteenth century which culminated in Japan's industrialization was postponed in China until the end of the nineteenth century. Even before Boxer indemnities had virtually absorbed all the revenue upon which the Chinese Government at Peking could dependably rely there was much casting about among officials for revenue with which to meet the ordinary expenses of administration, and as a result many concessions were given to foreign financiers in exchange for substantial loans. With the growth of trade the customs revenue—to which later was added the salt revenue, also under foreign control—was sufficient to meet the interest and amortization on a large number of loans for the building of railroads and the development of mines, forest, and other natural resources.

When China entered the World War in 1917 the postponement of Boxer indemnity payments gave a largely increased surplus to the Government. Unfortunately this surplus, which might have gone far toward reducing China's foreign gold indebtedness at the then high price of silver in which it was being collected, was used for other purposes, and moreover further heavy foreign borrowings, hypothecating practically all of China's available natural resources, were made. As a result the present Government finds itself saddled with an enormous debt, the interest and amortization on some of which cannot be met from available revenue.

Nevertheless, China's foreign trade has continued to increase. Year by year the value of shipments and receipts has mounted, and after the goods have reached the ports they have found their way to interior markets despite many impediments and handicaps. With the manufacture in China of a large share of China's needs in textiles, the foreign merchant in the ports who used to depend upon the textile trade for his "bread and butter" is forced to turn to other classes of commodities. While textiles represent 30 per cent. of China's import trade, the machinery with which to manufacture them in China, the iron and steel necessary to build the modern factories, and the large demands for other manufactured goods, following inevitably in the wake of industrial development, have turned the general merchant into a specialist, because most of these lines need more specialized treatment than textiles.

As these merchants in the ports are not permitted by treaty to reside in the interior they have had to depend upon Chinese distributors to get their goods to the inland consuming centers. The tendency among foreign manufacturers is becoming stronger, therefore, to deal direct with Chinese distributors, although in such lines as machinery, for example, foreign intermediaries in the ports will be needed for some years to come, both to finance and to give service on individual sales. The old general import and export house with hundreds of varied agencies is therefore being transformed into a house specializing in the output of a dozen allied industries, with direct representatives from the manufacturer giving service under the supervision of a local manager, who attends to financing and delivery.

One of the most noteworthy changes in the foreign trade of the Far East is the gradual passing of the old type of general merchant and the opening of an era of specialization in distribution. For years the cost of doing business in the Orient has been greatly increased by the multiplicity of intermediaries. An American product destined for a consumer in Java would be ordered through a Dutch house in Batavia with a head office in Rotterdam, which in turn would place the order with an American manufacturer through its New York agents. When the American goods reached

the consumer in Java the laid-down price bore the burden of all this roundaboutness.

The movement to buy direct is being fostered by the dealer in Java himself. He is welcoming direct representatives of American manufacturers and encouraging them to open direct distributing agencies. This development will require careful study, inasmuch as American sales agencies must compete with long-established European houses whose hold on the market is based on experience and adequate shipping and financial facilities.

We sell the Far East only half as much as we buy from it. While America is one of the principal outlets for the products of the Orient and our purchases of its raw products increase year by year, our sales remain stationary. Without the American market for rubber and tin, British Malaya would languish in poverty; and a withdrawal of American's demand for Indian jute, manganese, and shellac would be felt most keenly.

Almost half of Japan's total export trade is raw silk—and America takes 80 per cent. of it. We supply Japan with most of its raw cotton in return; but our share in the import trade of British Malaya, the Dutch East Indies, India, and other tropical countries is negligible. One of our greatest problems is to increase our export trade to these countries.

The key to British and Dutch commercial success in their tropical colonies is in their trading organization. Their general-merchant house could not have survived the long years unless they had bought as well as sold. The policy of American organization is quite different. The American firms as exist in the tropics specialize in either selling or in buying, but few if any of them combine the two under a single overhead expense, as do the more successful European houses.

The latter have found that the demand for any single group of imports into these countries is not large enough to support simply a selling organization, whereas the steady demand for export products furnishes a basis for the maintenance of their staffs and permits them to take immediate advantage of opportunities to sell. Many of our smaller users of tropical oriental products still buy them in London or Rotterdam, notwithstanding the obvious advantages of direct purchases. If they could combine with the smaller exporters in the formation of a single organization in Singapore or Batavia, all would benefit.

Silver

Both the Indian and Chinese currencies are based on the price of silver as a commodity and fluctuate with that metal. The rupee does not suffer the daily fluctuation of the tael, being influenced and stabilized somewhat by Government transactions in sterling; nevertheless the fact is that "wash" sales of exchange are advantageous in both countries. Such sales can be most satisfactorily consummated if buying and selling are engaged in and sales to the interior are counterbalanced by purchases from the interior.

Exchange banks in China provide a way of removing most of the risk in forward transactions in silver, but they do so at a profit to themselves, and the importer who can also export is in a very advantageous position. In China, particularly, high silver means stimulation of imports and low silver stimulation of exports. American firms doing a one-way trade must either speculate in silver or tie up their capital in "hedging" operations in silver exchange. The amount of capital required to do one-way business safely is therefore just as great as if native products were bought with the proceeds of sales, and in the later case a two-way profit would be realized.

How Investment Helps Trade

The many obvious advantages of American investment in the Orient both export and import business deserve mature consideration alike from those who are seeking a market and from the larger users of oriental products. In China many opportunities for investment in industrial enterprises present themselves, but those located in the treaty ports and offering American control seem most promising. Sales of machinery can be more easily consummated if stock in an enterprise is taken in partial payment, but too much care can not be exercised in the management and location of the business so that it escapes the evils of nepotism.

and remains under foreign jurisdiction and is not subject to confiscatory taxation.

The taxation policies in many of these colonies also must be carefully examined, as they tend toward assessing "all the traffic will bear"; and local regulations, too, can be irksome. New legislation in the Philippines removing the 2,500-acre limitation on land holdings by Americans and permitting the entrance of indentured Chinese labor for purposes of clearing and planting has been suggested by some observers as a possible encouragement to American investment in Philippine rubber lands. Some rubber is being grown in the Philippines to-day at a cost which compares favorably with the average cost in the British and Dutch East Indies. (See "Possibilities for Para Rubber Production in the Philippine Islands," issued as Trade Promotion Series No. 17 by the Bureau of Foreign and Domestic Commerce, Washington.)

Growth of America's Trade with Asia

The gain (12 per cent.) in our imports from the Far East during the fiscal year ending June 30, 1925 is entirely due to industrial activity in the United States and expanded markets for oriental products in our industries. The following figures show this increase:

United States imports from the Orient

Countries of origin	Value (000,000 omitted)			Percent change, 1925 over—		
	1914*	1924*	1925*	1924		1914, increase
				Increase	Decrease	
Japan	\$107	\$325	\$342	5	—	220
China	40	158	147	—	7	268
Straits Settlements ...	26	143	187	31	—	619
British India	74	108	125	16	—	69
Philippine Islands ...	18	90	101	12	—	461
Australia... ..	17	32	43	34	—	153
Dutch East Indies ...	5	55	69	26	—	1,280
New Zealand	5	13	19	46	—	280
Other Asia and Oceania	37	68	81	19	—	114
Total	329	992	1,114	†12	—	†233

*Fiscal years ending June 30.

†Net average.

A somewhat lower price level during the fiscal year 1925, bad economic conditions in Japan, and disturbed political conditions in China account for the decline in our export trade to the Orient.

United States exports to the Orient

Countries of destination	Value (000,000 omitted)			Percent change, 1925 over—		
	1914*	1924*	1925*	1924		1914, increase
				Increase	Decrease	
Japan	\$51	\$283	\$216	—	24	324
China	26	124	89	—	28	242
Australia... ..	46	129	132	2	—	187
Philippine Islands ...	27	56	61	9	—	126
British India	11	34	34	—	—	209
New Zealand	9	27	33	22	—	267
Dutch East Indies ...	4	14	15	7	—	275
Straits Settlements ...	4	7	9	29	—	125
Other Asia and Oceania	19	46	36	—	22	90
Total	197	720	625	—	†13	†217

*Fiscal years ending June 30.

†Net average.

The oriental trade balance against the United States was \$172,000,000 during the 1922 fiscal year. In 1925 it had grown to \$489,000,000, our shipments to the Orient amounting to 56 per cent. of our imports from the same source this year.

United States trade balance with the Orient, fiscal year 1925

Countries of origin or destination	Imports from	Exports to	Excess of imports	Excess of exports
Japan	\$342,355,610	\$216,427,527	\$125,928,083	—
Straits Settlements ...	186,873,239	8,745,728	178,127,511	—
British India	124,547,519	33,856,643	90,690,876	—
China... ..	147,288,503	89,008,726	58,279,777	—
Dutch East Indies ...	69,402,860	15,414,468	53,988,392	—
Philippine Islands ...	100,881,243	61,391,756	39,489,487	—
Australia	43,261,839	131,955,360	—	\$88,693,521
New Zealand	19,329,833	32,755,301	—	13,425,468
Other Asia and Oceania	79,639,191	35,063,945	44,575,246	—
Total	1,113,579,837	624,619,454	591,079,372	102,118,989
Balance for the year ...	—	—	488,960,383	—

The Department of Commerce, realizing the growing importance of Asia to American industry, is doing a great deal toward promotion of trade through Government channels. The need for Government assistance in the Orient is particularly pressing because of the missionary character of any new enterprise designed to increase our trade with that part of the world. The Bureau of Foreign and Domestic Commerce is therefore attempting to eliminate so far as possible the risk involved in new American undertakings in the Orient by accumulating information on the correct methods of buying and selling, by keeping abreast of the economic changes in all the countries so as to advise merchants in advance of any impending changes, and by pointing out specific opportunities for the sale of American goods in the best markets.

During the fiscal year 1923-24 the bureau established a new office in Batavia, Java, which is looking into the opportunities for the sale of American machinery and iron and steel products, and also advising definitely on the many opportunities for the investment of American capital in the rubber, tea, tobacco, and tapioca plantations of this rich colony. The bureau has also strengthened its Indian organization by opening an office at Bombay, and its China and Australia organizations by offices at Canton and Sydney.

Besides these major developments, the staffs in all offices have been augmented by the appointment of additional assistant trade commissioners, and the bureau now maintains well-equipped and full-staffed organizations of experts at Tokyo, Peking, Shanghai, Canton, Manila, Batavia, Calcutta, Bombay, Melbourne, and Sydney.

The Orient is rapidly becoming one of the leading sources of raw materials for our factories, and the industrial development in Japan, India, and to a lesser extent in China, is opening up wider markets for our products. Along with this development new methods of doing business, involving more direct relations between our manufacturers and their oriental customers, are being rapidly introduced. Our great buying power in the Far East should be harnessed to our selling effort and made to "pull" for American sales. This can be helped by broader American investment as an aid to both import and export trade. American interest in the Orient is increasing with more intimate and direct relations due to growing trade, and the new Asia which is growing out of the old is becoming a definite field for American enterprise.

Siamese Gunboat Ratanakosinde*

During the month of August the Royal Siamese gunboat *Ratanakosinde* has successfully completed her sea trials, and is now complete and ready for her voyage to Bangkok. On the 7th August a twelve hours' endurance trial was carried through, the vessel attaining a mean speed of 10½ knots, with the machinery developing 50 per cent. of its designed power.

On the 10th August the vessel proceeded to sea for the purpose of carrying out her full power, steering, anchor, and gunnery trials. All these tests were passed through satisfactorily. During six runs on the Admiralty measured course the designed speed was exceeded by 0.982 knots, with the engines developing their designed power. No attempt was made to press the machinery, and it is probable that a speed of 13 knots could have been obtained if desired. The vessel proved to be an excellent sea boat and no noticeable vibration was experienced when the engines were developing full power. On the steering trials it was found that the boat could reverse her direction in the remarkably small space of three lengths, and that she possessed exceptional powers of manoeuvring. During the gun trials two broadside salvos were fired in rapid succession with an entire absence of damage to the structure or fittings. The anchor trials have been successfully carried through and the vessel returned to the Tyne for her final docking and opening up.

All who have visited the *Ratanakosinde* are impressed with the compactness of the boat, and the wonderful offensive and defensive features which have been incorporated in a vessel of such limited displacement. It is confidently anticipated that when commissioned she will form a valuable addition to the Royal Siamese Navy.

*See Far Eastern Review September 1925, page 623

Fiftieth Anniversary of the Link-Belt Company

FIFTY years have passed since the incorporation of the Ewart Manufacturing Company, the forerunner of the present Link-Belt Company, in 1875. In commemoration of the fiftieth anniversary, the Link-Belt Company has published an attractive book entitled "Link-Belt 1875-1925."

In this book it is mentioned that the patent of William Dana Ewart, a young implement dealer, from Belle Plaine, Iowa, for the detachable link chain, was dated September 1, 1874. Mr. Ewart first started to build a self binding harvester, but he realized the great need in such a machine for a detachable chain drive that could be repaired in the field; and he worked out the idea of a chain drive, the links of which could easily be replaced by the farmer, who up to that time had been wasting much time in going back to the barn or black-smith shop for necessary repairs to the "strap-link" chain drives that were used on some of the first crude binders; or trying to adjust the flat belts, which stretched and tightened under varying conditions of heat or moisture in the field.



Alfred Kauffman, President Link-Belt Company

Late in 1874 Mr. Ewart came to Chicago with a view to arousing some interest in his "detachable link chain," he succeeded in interesting John C. Coonley, a lawyer who was then President of the Chicago Malleable Iron Company. As a result a company was duly incorporated in 1875, under the name of the Ewart Manufacturing Company, for manufacturing detachable link chain. In 1876, the Ewart chains were exhibited at the Philadelphia Centennial.

New uses for the invention developed rapidly, and in 1880 the Link-Belt Machinery Company was incorporated "to design, build, and supply accessory parts, and install elevating and conveying machinery employing Ewart Chains," the plant for this company was built in Chicago.

In 1888 the Link-Belt Engineering Company was formed with a plant in Philadelphia. These two plants found increasing numbers of new uses for the chain, with the result that all three plants continued to grow in size until in 1906 a consolidation of the three interests took place, and Charles Piez elected President.

It will be remembered that Mr. Piez was Director General of the Emergency Fleet Corporation during the World War.

Mr. Piez is now Chairman of the Board of Directors, and Alfred Kauffman formerly Vice-President in charge of the two Link-Belt in Indianapolis is now President of the Company.

From the humble beginning in 1875 this company now operates and owns ten large manufacturing plants, with seven shops and warehouses, and twenty-seven branch offices, and its products now include Elevating and Conveying equipment for all kinds of materials; complete equipment for the handling and cleaning of coal, on the ground and in the boiler house, complete coal Tipples and Coal



Charles Piez, Chairman of the Board, Link Belt Company

Washing Plants, Sand and Gravel Washing and Preparing plants, Sand Preparing and Conveying Machinery for the modern foundry, Locomotive and Crawler type cranes, Silent Chain drives for industrial plants, and for the front end of the automobile—in fact, Link-Belt today builds complete equipment for Conveying handling and power transmission.

A Hydro-Electric Undertaking in Northern Korea

SANCTION for hydro-electric development on the River Choshin, Kankyo Nando, Korea has been granted to the Chosen Hydro Electricity Co., the principal promoters of which are Count M. Soejima and Mr. S. Noguchi, Managing Director of the Japan Nitrogenous Fertilizer Co. The Company whose authorized capital is Yen 30,000,000 aims at erecting three hydraulic power plants capable of generating 121,900 k.w. at Shoko and Toko and also meeting general demands in the northern part of Korea in the future, co-operating with the undertakings of the Japan Nitrogenous Fertilizer Co. The activities of the Company are expected to revolutionize the electricity of Korea which at present demands only 30,000 k.w.

According to Mr. Ichikawa, director of the Japan Nitrogenous Fertilizer Co., the plan of the new undertaking is to build a dam on the Fusenko, a tributary of the Yalu River in Kankyo Nando and to connect the water with the Josenko in the rear by digging a tunnel through the mountain at the upper course of the former river, thus utilizing 4,000 "skaku" of head which is made to cascade the water from the reservoir on the Fusenko down to the Josenko. They will be capable of generating some 100,000 k.w. with which about 200,000 tons of sulphate of ammonia are to be produced annually.

The Commercial and Industrial Position in Japan

A PART from the great loss of life and the extensive material damage caused, the earthquake which befell Tokyo and Yokohama on September 1, 1923, was a very severe blow to Japanese prosperity, says "Engineering." The Government was obliged, on the one hand, to vote sums for reconstruction purposes, and, on the other, to make allowance for a reduction in revenue consequent upon the disaster. The decrease in tax receipts due to the catastrophe amounted to 130 million yen, and, in order to avoid serious disturbance of the national finances, public works were postponed, and expenditure was cut down in every way possible. While the earthquake undoubtedly exerted a profound moral effect on the people, the productive power of the nation was not greatly affected because the devastated areas were largely residential, and main industrial centres such as Kwansai and Kyushu remained intact. There was, however, a decrease in exports during 1923 and a considerable increase in imports. According to the Financial and Economic Annual of Japan for 1924 issued by the Department of Finance, exports amounted to 1,448 million yen in 1923, and imports for the same year totalled 1,982 million yen. The figures for 1922 were 1,637 million yen and 1,890 million yen respectively. Thus, the excess of imports over exports, already considerable in 1922, appears to have been further intensified by the earthquake in the Kwanto district.

In the matter of imports it is interesting to note that in 1923 British India supplied more than a third of the requirements in "pig-iron and steel blooms and billets"; China took second place. Imports from Great Britain in this section have decreased rapidly since 1919, and the share held by the United States has dwindled still more quickly. In "iron and steel bars, rods, plates, sheets, wire goods and tubes," trade with Great Britain has increased steadily since 1921, chiefly at the expense of the United States, although Germany and Belgium are serious competitors. The import trade in machinery and machine parts, which was very steady during the years 1920-22, decreased in 1923. The United Kingdom supplied goods to the value of 36 million yen in 1923 and 42 million yen in 1922; the values of goods supplied by the United States were 42 million yen in 1923 and 57 million yen in 1922. Imports from other countries are small in comparison, although here again German trade is increasing. Since 1917, the first year quoted in the annual, United States manufacturers have had the motor-car import trade entirely in their hands. In 1923, cars to the value of 13 million yen were imported, nearly 10 million of which were received from American concerns. Building materials are largely supplied by the United States, the only competitor worthy of note in the year 1923 being Germany. Other imports include raw cotton and cotton goods, foodstuffs, and wool and woollen goods. British India supplies more than half the raw cotton, Australia has three-quarters of the wool import trade, while Great Britain has for years practically monopolised the market in cotton and woollen tissues. Exports consist chiefly of silk goods of all descriptions, together with manufactured articles of a very varied nature and foodstuffs. Some coal is exported, China and Hongkong being the two chief customers.

Agriculture holds an important place in Japan, and large areas are devoted to the cultivation of such crops as rice, barley, and wheat; a considerable income is also derived from the State forests. The silk industry is steadily growing, the total raw silk produced in 1922 being 24 million kilograms as compared with 14 million kilograms in 1913. Tea planting is another important branch of industry. Turning to mineral products, the annual shows that, whereas outputs of silver, copper and lead have fluctuated and, in the main, have diminished since 1914, the production of pig-iron and steel has increased enormously. In 1914 the outputs of pig-iron and steel were relatively insignificant; the figures were 74,049 metric tons and 15,385 metric tons respectively. This tonnage rose during and after the war almost without a break, and for the year 1924 the output of pig-iron was 530,536 metric tons, and that of steel 195,433 metric tons. The quantity of coal mined in 1914 is

recorded as 22 million metric tons; the output for 1923 was 29 million tons, showing a steady increase. On the other hand, the production of crude petroleum has decreased from over four million hectolitres in 1914 to less than three million in 1923.

Although introduced at a comparatively recent date, the Tokyo-Yokohama section having been laid down as a government undertaking in 1872, railways in Japan are extending rapidly. In 1905, there were 4,778 miles of track, and a point of interest is that, out of this total, 3,247 miles are owned by 38 different companies. The main trunk lines themselves are controlled partly by the State and partly by private companies. Economic expansion demanded greater efficiency than was possible under these conditions and, in 1906, a Railway Nationalisation Bill was passed; under this measure the government acquired nearly 3,000 miles of privately-owned roads. In 1923, the mileage opens to traffic measured over 9,000 miles, as compared with 6,500 in 1913; in the same interval the number of locomotives increased from 2,700 to 4,300. During the same decade the number of passengers more than trebled, and the goods traffic nearly doubled.

The territories constituting Greater Japan—Korea (Chosen), Formosa (Taiwan), Japanese Saghalien (Karafuto), and Kwantung Province are all undergoing development. Korea is largely an agricultural and pastoral country, but iron and mild steel are also exported, although quantities have fallen off somewhat since 1921. Korean railways are expanding, and the weight and value of traffic of all descriptions are steadily increasing. In addition to gold and silver, zinc, copper, lead, iron, tungsten ore, graphite, coal and kaolin are also found. The country is especially rich in gold, iron, graphite and anthracite. Afforestation is encouraged, and is making great headway; the fisheries are also important. Industry in Korea is, it is stated, in a promising condition generally. The chief products of Formosa are derived from its agriculture, and its fisheries, but in the northern portion of the island are situated deposits of gold, silver and copper; petroleum and coal are also found. The latter commodity holds an important position among the exports of the island. Extensive beds of coal have also been found in Saghalien. Three important seams have been discovered—northern, central and southern. Of these the central is the most extensive; it is 60 miles in length, and is from 3-ft. to 9-ft. thick. Mining operations, however, have only just begun, and are at present conducted on so small a scale as barely to satisfy the needs of the island. Petroleum has also been located, and the matter is being further investigated. The South Manchurian Railway ceded by Russia to Japan in September, 1905, and since conducted by the South Manchurian Railway Company, created for the purpose, is fast increasing in importance, as the following figures show. The passengers carried in 1914 and 1923 were 3,600,000, and 8,760,000, respectively, the tonnage of goods hauled was 5,700,000 in 1914 and 13,370,000 in 1923, while the net income increased from just under 15 million yen in 1914 to nearly 56½ million yen in 1923.

As is the case with the majority of other nations, the after effects of the war, and of the boom period, immediately following it, still exercise an influence upon the commercial and industrial welfare of the Japanese people. There has been no remarkable fall in the price of commodities, and wages are, on an average, three times as they were in 1912, with a tendency to further increase. Moreover, high as the national debt, which in the years 1915-18 stood at 2,500 million yen, reached a total of over 4,000 million yen in 1924. Taxes averaged 13 yen per head of population in the year 1923-24, or about double the pre-war figure. Taken altogether, however, the situation in Japan is one of progress, and the outlook is promising.

Japan's Electrical Imports and Exports

Since the earthquake in Tokio and Yokohama, which caused the destruction by fire of a quantity of the Government's statistical data, the Japanese import and export trade returns have not been issued in very great detail. It is, however, now possible to compare the figures for 1922, 1923 and 1924. The following table shows the

values of Japan's imports and exports of electrical and allied material during these three years. It will be noticed that exports, except those of telephones and electric lamps, have declined progressively, whilst in 1924 imports of electrical machinery were unusually large.

EXPORTS.

	1922 Yen (Thous.)	1923 Yen (Thous.)	1924 Yen (Thous.)
<i>Insulated electric wire.—</i>			
Total	7,816	1,609	1,373
To China	6,712	661	317
„ Kwantung	849	677	889
„ Hongkong	164	63	91
<i>Electrical machinery.—</i>			
Total	3,028	1,185	1,755
<i>Telephones.—</i>			
Total	119	154	143
<i>Electric lamps.—</i>			
Total	1,244	1,335	1,829

IMPORTS.

<i>Insulated electric wire, submarine telegraphic or telephonic cables</i>	831	443	736
<i>Other cables</i>	485	1,885	717
<i>Wattmeters</i>	1,409	1,252	3,868
<i>Telegraphic or telephonic instruments and parts</i>	1,359	859	4,338
<i>Steam boilers and parts</i>	6,403	2,949	5,473
<i>Steam turbines</i>	1,052	499	2,298
<i>Steam engines</i>	121	140	32
<i>Water turbines</i>	2,979	3,028	1,463
<i>Dynamos, motors, transformers, etc.</i>	11,947	10,835	20,978
<i>Dynamo sets</i>	877	525	368
<i>Electric carbons</i>	358	314	606

Three New P. & O. Liners

THE *Rampura* is the latest addition to the P. & O. fleet. She is a sister boat to the *Ranchi* which is now almost completed.

The *Rampura* is to undergo her trials at the end of March, and considerable interest attaches to her since she is the first vessel ever constructed for the line by Messrs. Hawthorn, Leslie, & Co., Ltd. of Hebburn, and if possible, the builders have enhanced their reputation by her production. The vessel is a very finely modelled and constructed steamer and is handsomely fitted out in every particular.

The *Razmak*, for the same line, recently ran a series of successful official trials in Belfast Lough, when she was taken over from the builders Messrs. Harland & Wolff, Ltd., by Mr. Frank Ritchie (joint managing director with Lord Inchcape) on behalf of the P. & O. Company.

Particular interest attaches to the *Razmak*, since she has been specially designed for continuous service in Indian and Oriental waters. At present she is to be employed on fortnightly trips each way between Bombay and Aden, taking on the Aden-Bombay voyage mails and passengers for India by transshipment from the outward bound fortnightly Australia steamer, and transferring on the Bombay-Aden trip, to the homeward Australia steamer, mails and passengers from India for Egypt, Marseilles, and London. She will alternate on this line with the fortnightly direct steamers in each direction between London and Bombay, thus maintaining the weekly frequency of the Indian mail service.

Her principal dimensions are:—Length 518 feet 6 inches; breadth, 63 feet; moulded depth, 37 feet 9 inches. The vessel has a straight stem and elliptical stern; and is fitted with two sets of quadruple expansion engines of the balanced type, developing 12,000 i.h.p., and burning oil fuel with forced draught under Scotch boilers.

Accommodation is provided on the bridge, upper and main decks for 142 first and 142 second class passengers and the dining saloons are arranged to seat simultaneously the whole of her passengers. The first saloon, music room, lounge, smoking rooms and verandah café are placed forward amidships on the bridge deck, while towards the after end of this deck are the second music saloon, verandah and smoking saloons. The decorative and color schemes of the *Razmak's* public rooms have been designed from suggestions by Lady Inchcape and the Hon. Elsie Mackay and carried out under

their supervision. On the upper deck, beneath the forward three-quarters of the deck is occupied by large first class-cabins arranged on the tandem principle, approximately every fourth one being a single-berth cabin. The first class accommodation includes four pairs of Cabins de Luxe, each arranged for one or two passengers and each including a private bathroom. The after parts of the upper deck and the main deck are occupied by second saloon cabins for two or three passengers, with one or two four-berth cabins to meet passengers' occasional especial need in this respect.

The *Razmak* is to replace the *Salsette*, of 6,000 tons, which was withdrawn from the Aden-Bombay line during the war and was sunk by an enemy submarine in the Channel on July 20, 1917.

The *Razmak's* arrival on the Aden-Bombay station simultaneously with the resumption of fortnightly sailings on the P. & O. Australia mail line is among the final steps towards the restoration of the company's services to the pre-war level. A part of this operation has included the assignment to the through fortnightly line to the Far East of the large mail steamers formerly employed in the Australia service, and these in turn have been replaced by the *Mooltan* and *Maloja* (21,000 tons), the *Naldera*, *Narkunda*, *Mongolia*, and *Moldavia* (16,000 tons), to which will be added shortly, also for service on the Australia line, the *Cathay*, *Chitral*, and *Comorin*, each of 15,000 tons gross. Four other steamers *Rawalpindi*, *Rajputana*, *Ranchi*, and *Ranpura* for the Bombay mail service, each of 16,000 tons—are in various stages of construction. The *Razmak* left on her maiden voyage on March 13.

The twin screw mail and passenger steamer *Cathay* completed successful trial trips in the Firth of Forth in mid-March, the main speed attained being 17½ knots.

The *Cathay* has passenger accommodation in a style never previously attempted aboard ship. Although of 15,200 tons gross register, and having three decks devoted to the accommodation of passengers, only 200 first class and 100 second class are carried, and are berthed in single-berth and two-berth cabins only, the number of single berth cabins being double that of the double-berth cabins. As a result the space allocated to passengers is in the region of twice the space that would, not so many years ago, have been allotted to them. The cabins, accordingly, are exceptionally large and airy, and are most completely equipped with every convenience and comfort that experience can suggest.

The public rooms, consisting of dining room, drawing room, smoking room, social hall and open air lounge for the first class, and dining room, drawing room and smoking room for the second class are on a corresponding scale; spacious, lofty, comfortably furnished and handsomely decorated, they provide with the extensive open-air promenades every opportunity for the comfort and pleasure of the passengers.

The length of the vessel is 545 feet, the breadth 70 feet, and the depth 46 feet, with a gross tonnage of 15,000. She will carry 11,000 tons deadweight, and of the total cubic capacity for cargo of 600,000 cubic feet, 300,000 is insulated for the carriage of refrigerated cargo preserved at any desired temperature by powerful refrigerating machinery.

The propelling machinery consists of twin-screw quadruple expansion balanced engines and seven large boilers of 220 lbs pressure, burning oil fuel under forced draught. Everything that contributes to safety, comfort and convenience has been installed, noteworthy among which are the most modern systems of handling the extensive number of life boats, the mechanical appliances for working the water-tight doors, the five large electric generating engines and dynamos, and the mechanical ventilation throughout the entire vessel.

The refrigerating plant was installed by J. & E. Hall Ltd., of Dartford. Messrs. Wailes Dove Bitumastic Ltd., have applied their bitumastic solution and bitumastic enamel to the tank tops in engine space and tunnel tops; bitumastic solution and bitumastic covering to the tank tops in insulated holds and evaporator room, and their heat proof cement to the tank top in boiler space. They have also applied their oil fuel bitumastic solution to the double bottom, storage and settling tanks.

The vessel is fitted with twelve sets of Maclachlan gravity davits, handling eleven 29 inch single life boats and a 30 inch motor life boat. Very successful tests of the speed and facility with which lifeboats may be launched by this apparatus were carried out prior to the vessel leaving the Clyde. A special feature of these tests was the efficient performing and controlling of the complete operation of lowering the lifeboats by any one of the Lascar crew.

Gold Mining in the Philippines

By Warren D. Smith

PRODUCTION of Philippine gold is higher than that of all other mineral products, and the industry remains almost entirely in the hands of Americans with some assistance from Australians and New Zealanders, who are first cousins to Americans in the mining business. In other countries the gold-mining business has fallen off greatly, but the Philippines has maintained a steady, though not large, output. The amount of gold produced during 1920 was only a few ounces less than during the banner year, 1916, when gold was actually worth more than it is now.

The Aroroy district leads the others in gold production owing to the continuous operation of its two mines, the Colorado and the Syndicate. Benguet, with a single large producer, alone almost equaling the combined production of the two in the Aroroy district, is second. Paracale, once in the limelight as a result of its rather remarkable, though small, dredging field, is to-day a mere reminiscence of its former self; only one dredge and a small ten-stamp mill are now operating.

The Benguet Consolidated, in Antamok Valley, has during the past few years, when many gold mines in other parts of the world have had to close down owing to the low purchasing power of gold, steadily paid dividends of from 25 to 35 per cent. At the present writing, the values on the lowest level of the mine are very encouraging, indicating possibly secondary enrichment in the vein. This mine is fast coming to be recognized as one of the notable small gold mines of the world.

The gold produced from Philippine mines during 1920 amounted to approximately 2,500,000 pesos; of this the Consolidated yielded 1,068,892.30 pesos.

In this chapter I have drawn freely upon an early paper by Eddingfield. (220) As I have since revisited most of the fields discussed in that paper I have accumulated new and fuller data in some cases which call for somewhat different interpretations. Nevertheless, it should be understood by the reader that Eddingfield does not incur any responsibility for modifications of his opinions which may appear in this chapter.

It is certain that gold has been extracted from the lodes and alluvials of the Philippines for centuries, long before the coming of the Spaniards. This is a matter of history and is covered in a later chapter.

Gold deposits have been found in nearly every island of the Philippine group; there is hardly a stream from which one cannot pan colors, or scarcely an area of igneous or metamorphic rocks wherein either large or small veins of gold-bearing quartz or calcite cannot be found.

In general we find the gold either in lodes (veins or ledges) or in alluvial accumulations known as placers. The latter class of deposits is further subdivided into high-level, or bench, placers and low-level deposits, in the river bottoms. Lodes are deposits in situ; the placers have been transported from lodes that exist elsewhere.

In the Philippines, as in other parts of the world generally, gold deposits, like most metalliferous deposits, are found in or near regions of igneous rocks; there are exceptions, where some lodes are near the contact of igneous rocks with sediments, or where the placers are found far down the streams in the flatter areas underlain by sediments.

As igneous rocks are the most resistant of the three classes and stand up as elevated masses, we naturally find the metalliferous lodes in or near the cordilleras. A few are found near old volcanic stocks or plugs, but scarcely any near recently active volcanoes. The gold deposits of the Philippines, like those of western America, are found associated with either andesites or diorites, principally; but, in one district, Paracale, they are in veins close to the contact of granite-gneiss and diorite-schist. By far the greatest number of veins is found in the andesite. Since there is, in some of the districts, both a later and an earlier andesite, and the paying veins are located in the earlier, it is important to be able to distinguish between them.

The vein matter fills fissures which are in many cases clearly tectonic. Faulting, with strong slickensides and considerable displacement of the veins, is pronounced in many districts. On this point I am not in agreement with Eddingfield, who expressed just the contrary opinion; later development in some of the districts, which he had not seen, has necessitated changing Eddingfield's statement.

The parallel arrangement of many of the fissures in all the fields, though less pronounced in Benguet, is noteworthy. The best lodes so far found and worked are in northwest and southeast fissures. It should be pointed out that these fissures are coincident in direction with one of the principal axes of the Archipelago.

In only one district (Baguio) has mining reached any considerable depth. In the Benguet Consolidated mine on the C level, at a depth of about 80 meters, the veins are keeping their width and values, and are even becoming richer.

According to Eddingfield, the most characteristic feature in regard to the ore deposits of the Philippines is the abundance of quartz-calcite-manganese veins. This is true also of many of the Tertiary gold deposits of the western United States. A characteristic section of this type of vein in the zone of oxidation consists of (a) a band of solid compact calcite, varying in width from 0.5 to 6 meters, often lying next to the foot wall; (b) bands of black, soft manganese, usually mixed with quartz fragments or honeycomb quartz, and often containing pockets of white quartz crystals which in some mines indicate high values; these bands are found in some cases next to the calcite, in some cases next to the foot wall, and almost always next to the hanging wall; they vary in width from 0.2 to 4 meters; (c) a band of massive quartz, carrying sulphides and varying in width from 0.1 to 4 meters, usually separated from the calcite by a manganese band.

In some fields oxidation of the ores has gone on to a considerable degree due to the shattered condition of the veins and the inclosing rocks. In these much of the calcite has been dissolved out, leaving a honeycombed quartz. Concurrently, there has been mechanical enrichment of the veins for a short distance with a decrease of values with depth.

In many veins, in the Baguio district especially, there appears to be little or no oxidation and no secondary enrichment, either chemical or mechanical. Eddingfield devoted particular study to the subject of secondary enrichment in veins bearing manganese. Of the quartz-manganese deposits studied he says: "In all of the samples, the richest ore is at or near the surface and the values found so far appear to decrease with depth."

In calcite veins, Eddingfield was of the opinion that there was some enrichment, but of a mechanical rather than a chemical nature. Only recently have indications of enrichment in the Benguet Consolidated mine been noted. The ore appears to be distinctly primary. This mine is now in its lowest workings, D. level, about 100 meters below water level.

Table 38 gives Eddingfield's excellent summary of the types of deposits in the several districts. To this I have added one or two important ones which he did not include.

According to the best authorities gold is deposited from solutions which are generally at high temperatures and are intimately related to deep-seated rock magmas. These solutions are in the first instance ascending, but descending solutions also play a part in deposition. With the gold content they reach fissures where they deposit siliceous and calciferous substances known as quartz and calcite, constituting the veins, or lodes. The fissures cut andesites, diorites, and granites, and even sedimentaries. In the Aroroy district they are in andesite, while in Benguet some are in andesite, others in diorite, and still others along contacts between sediments and the igneous rocks.

Philippine lode deposits appear to be of rather late origin, probably all dating from the Miocene Revolution. In Benguet it seems that the mineralization has continued into the Recent. Traces of gold can be detected in the travertine being deposited in the Itogon Hot Springs at the present time.

TABLE 38.—*Gold-bearing veins.*
SUYOC, BENGUET.

Mine.	Type of vein.	Width.	Strike.	Dip.	Vein filling.	Minerals.	Secondary enrichment.	Milling character.
		<i>Meters.</i>						
Elizabeth	Fissure	1	Northeast and southwest.	—	Quartz, calcite	Gold, copper, lead, zinc, iron, manganese.	—	
Quien Sabe	do.	12	North and east	—	Quartz	Gold, pyrites, copper.	—	
Palidan	do.	1-5	—	—	do.	Gold, pyrites	—	

BAGUIO, BENGUET.

Headwaters	Fissure in andesite.	2-8	North 65° east	50° north-west.	Quartz, calcite, manganese.	Gold, galena, pyrites, manganese.	In manganese streaks.	Concentration in part, principally fine grinding and cyanidation.
Consolidated	do.	10-30	South 70° east	65° south-west.	Crushed quartz	Gold, pyrites, manganese.	On foot and hanging walls and along manganese streaks.	Fine grinding and cyanidation.
Bua	Fissure in andesite (2 veins).	1.5 each	North 70° east	65° south-west.	Calcite, manganese.	do.	In streaks of manganese.	do.
Fianza	Fissure in andesite.	2-10	South 70° east	40° south-west.	Quartz	Gold pyrites	Enriched portion has been eroded.	Concentration, fine grinding, and cyanidation.
Madison	Fissure in andesite and partly contact with diorite.	5-10	South 55° east	85° south-west	Quartz, calcite, manganese.	Gold, pyrites, manganese.	Very marked in manganese streaks.	Fine grinding and cyanidation.
Camote-Clayton	do.	5-10	South 55° east	85° southwest.	do.	do.	do.	do.
Magma	Fissure	50+	North and south.	East	Quartz	Gold, pyrites, sphalerites, etc.	do.	Flotation (?)
Eileen	Fissure in andesite.	3	South 55° east	70° south-west.	Quartz, calcite, manganese.	Gold, pyrites, manganese.	In streaks of manganese.	Cyanidation.
Lincoln Fraction	Fissure in diorite	5	do.	45° south-west.	Calcite	Gold, pyrites	—	
Kelly No. 3.	Fissure in andesite.	3-5	East and west	70° south	Quartz	Gold, gold telluride, pyrites.	Along the walls	Concentration, followed by cyanidation.
Kelly South Slope	do.	4-7	South 80° east	65° north	do.	Gold, pyrites	General near surface.	
Muyot	do.	3-6	do.	do.	do.	Gold, pyrites, copper.	Occasional rich streaks; values are leached.	Concentration and cyanidation
Tejon Dike	do.	2-4	do.	—	do.	Gold, pyrites	do.	
Emerald Creek	do.	2-8	South 45° west	60° north.	do.	Gold	In seams and pockets, vein much oxidized.	
Major Engineer	Contact shale and andesite.	2-3	North 80° east	80° north	do.	Gold, pyrites	—	
Major	Contact sand, stone, and andesite.	3-6	North 60° east	60° north-west.	do.	do.	—	
Major Electrician	Fissure in andesite.	3-5	North 25° east	57° north-west	do.	Gold	—	
Copper King	do.	4-6	Approximately east and west.	—	do.	Gold, pyrites, copper.	—	

AROROI, MASBATE.

Colorado	Fissure in andesite.	5	North 45° west	70° north-east.	Quartz, manganese, calcite.	Gold, manganese	Very marked in manganese streaks and by leaching out of calcite.	Cyanidation.
Eastern Nancy No. 1.	do.	3-10	do.	70° south-west.	do.	Gold, pyrites, manganese.	Very marked in upper workings and along manganese streaks.	do.
Keystone	do.	3-5	North 40° west	—	do.	do.	—	
Tengo	do.	3-5	—	—	Brecciated quartz	Gold, pyrites	In upper workings.	

PARACALE, CAMARINES NORTE.

San Mauricio	Fissure in schist and gneiss.	1-3	North 10° east	70° south-east.	Quartz	Gold, silver, copper, pyrites, galena.	Along foot wall	Concentration and smelting or roasting and cyanidation.
Tumbaga	Contact andesite and sedimentaries.	Stringers	Northeast and south-west.	—	Calcite, quartz	Gold, lead, zinc, pyrites.	—	Free milling or concentration.
Longos Point	Fissure in gneiss	10	do.	—	Quartz	Gold, pyrites	—	
Navotas	do.	Stringers	do.	—	do.	Gold, lead, zinc	—	
Nalasvetan	Enriched zone in andesite.	5-10 (pocket)	North 30° west°	—	Silicified material	Gold, manganese, pyrites.	Surface	Free milling near the surface.

Values, of course, vary. Some very rich pockets running as high as several thousand pesos to the ton have been opened, but as a rule the ores are low grade. The Benguet Consolidated mine, the richest property in the Philippines, has an ore body that averages between 40 and 50 pesos (20 and 25 dollars) per ton. The Masbate ores run considerably less.

The Paracale District (Lode and Placer)

History.—The Paracale-Mambulao gold field has for centuries been known to the Filipinos as rich in gold.

The first mention of this district of which we have an authentic record was in 1571. The Chinese and Filipinos worked the rich streaks and alluvial ground for many years in a crude way, until Spaniards from Mexico taught them to use the arrastre; a few years before American occupation nearly a score of these crude appliances were in use in the hills of this district. Small but fairly effective dipper dredges made of bamboo (Plate 24), which could handle only a few cubic meters a day, had been set in operation.

A large British corporation known as the Philippine Mineral Syndicate had acquired, just before the insurrection of 1896, extensive concessions from the Spanish Crown. Operations of a modern character were first undertaken on the Tumbaga property. However, these early attempts came to naught, owing to the disturbed political conditions.

Soon after order had been established in the Islands, discharged American soldiers and others were attracted to this region, and active development began. Finally, with the aid of New Zealand and Australian capital and miners, the district reached its peak of production and prosperity in 1914, when there were nine dredges at work. Since that time there has been a gradual decline, until to-day only one dredge is digging. There has never been any very successful quartz mining in the district.

The district comprises, roughly, 400 square kilometers of country of moderate relief. The topography is marked by a number of hills, which extend outward as spurs from the cordillera and have approximately a north and south trend. Between the hills are broad valleys, to a great extent filled with nipa and man-grove swamps. The whole country is densely wooded. The most elevated point in the district is Mount Bonotan, some 500 meters in height.

Metamorphic rocks are a prominent feature of this area. The formations are pyroxenite, schist, granite-gneiss, shale, sandstone, and andesite, from north to south in the order named. The strike of the sedimentaries is, roughly, north and south, and they now stand nearly on end.

Prior to the Miocene disturbance, which flexed these formations into a more or less vertical position, the section of the strata was probably as follows: At the base a pyroxenite and diorite complex; above this sandstone, shales, and possibly limestone, with andesite overlying. With the Miocene uplift there probably occurred an intrusion of granite; exposures of the granite cutting across the basic rock can be seen. Along the contact of the two, gneiss and schist were developed. Later, and probably before the outflow of andesite, there began a period of vein filling and ore deposition. Naturally, the principal deposition took place along the weak zone of the contact and in the fractures adjacent to it. The principal lodes to-day are found normal to this granite-diorite contact. There are also many parallel veins running through this granite batholith. The placer deposits are found along the rivers that cut across these veins and are naturally richer near them.

Mambulao.—In 1908 the ancient workings and those of the Philippine Mineral Syndicate (which were interrupted by the

insurrection of 1896) were the only ones in the district, together with a few recent shafts and tunnels driven as assessment work. Shortly after, two companies developed and for a time worked two properties, the Tumbaga and the San Mauricio, which had been discovered and partially developed during Spanish times.

Tumbaga.—The Tumbaga property has only recently exhibited activity, though a few years ago it figured prominently in the local newspapers. It is one of those tantalizing deposits with exceptional streaks of high-grade ore, but apparently without body enough to put it in the producing class.

This property is situated 2.5 kilometers south of the town of Mambulao. The ore body is in a brecciated zone between a sort of arkose (more or less tuffaceous) and andesite. The trend of the ore body is northeast and southwest. In this there is considerable slate, through which innumerable calcite stringers ramify, some of which have been found to carry free gold. It is more than probable that the values will be found to be confined to these veinlets that cut the slate, and not in the body of slate itself as some have supposed. The absolute determination of this point will, of course, considerably affect our ideas as to the size and value of the deposit. The slate body is more or less lenticular and faulted and is about 10 meters wide.

Mr. A. C. Cavender worked this property for a time (from 1910 to 1912) with a small and rather inexpensive plant consisting of the following: Blake crusher, 5-foot Huntington mill, two Johnson concentrators, and the usual accessories. In November, 1909, on a trial run of twenty-two hours, 11 tons of ore produced 93.6 ounces, which represented merely the free-milling part of the ore. The hopes of the early operators of this property have not materialized, and to-day (1922) the plant is idle.

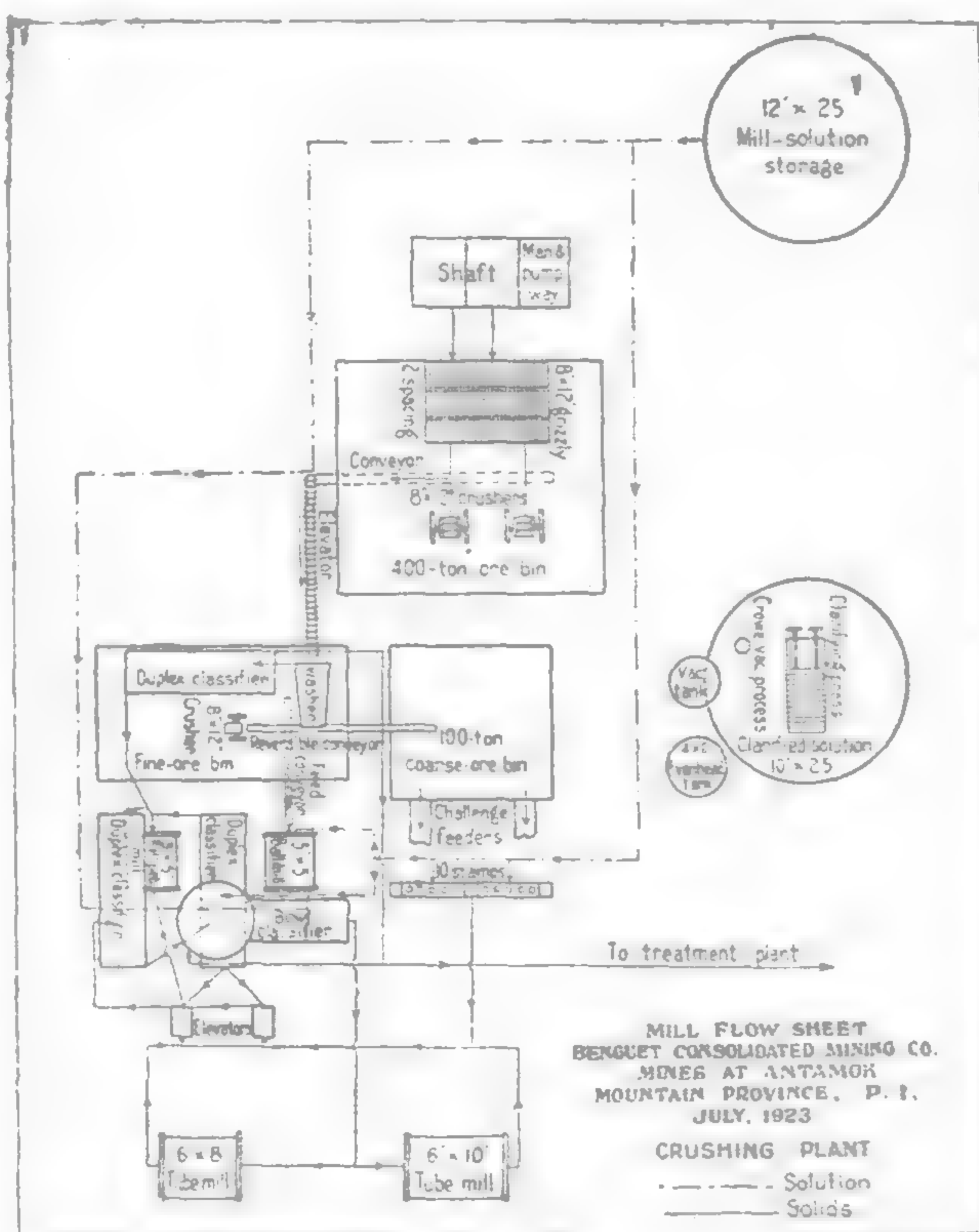
San Mauricio.—This property is located 1 kilometer from Mambulao, on the hill northeast of the town. The ore body is in part a quartz filling, normal to the contact between the granite and the basal rock, which here is more nearly a diorite than a pyroxenite.

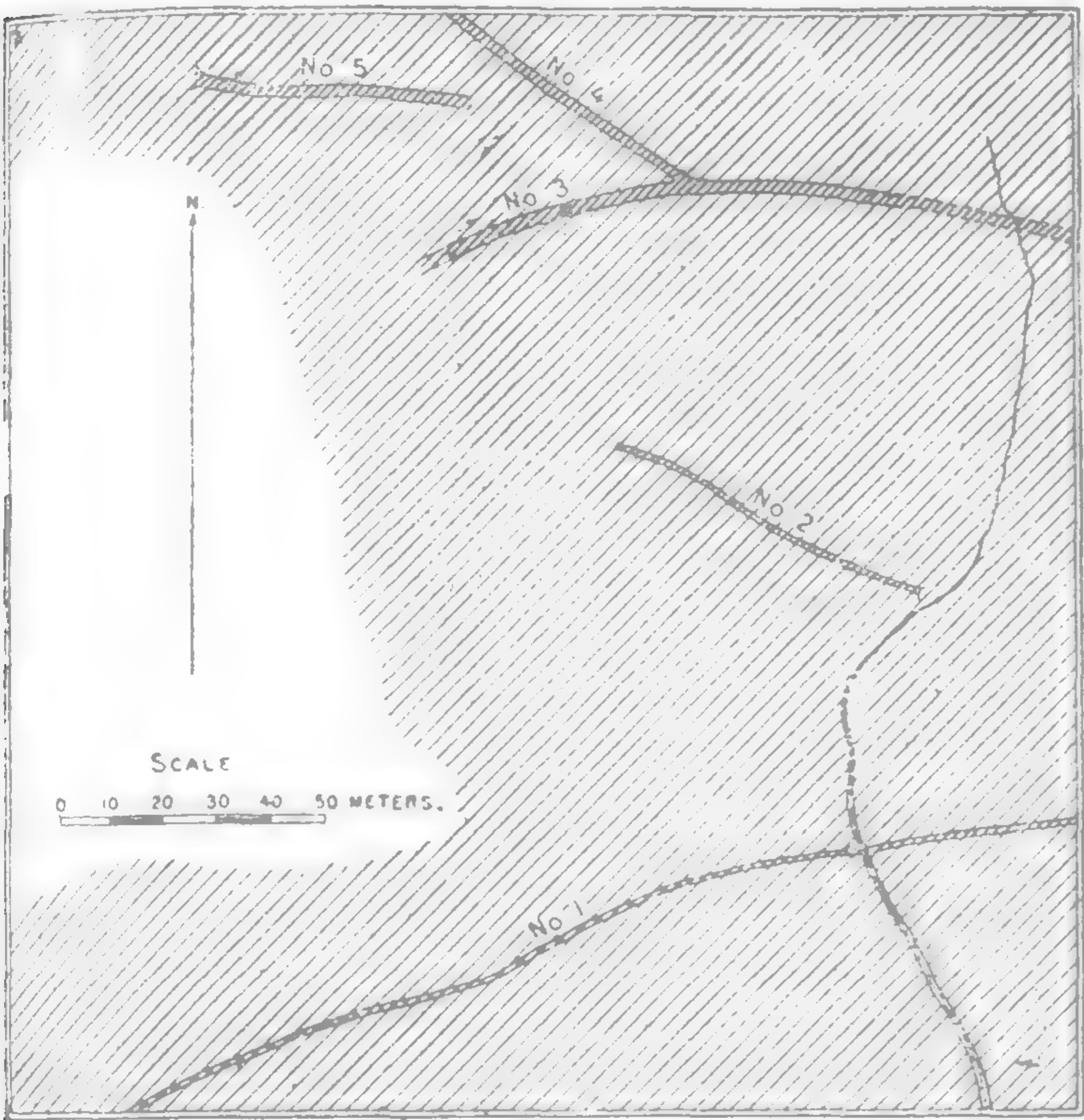
In 1909 several hundred meters of drifts and crosscuts were opened. A drainage tunnel 500 meters long, from near sea level, was completed and connected with the main shaft. Besides this development work, a 20-stamp Traylor mill, consisting of the following parts, was erected; 20

Traylor stamps, Blake crushers, Challenge feeders, 8 Traylor concentrators, and a Richard's classifier. The stamps are 1,050 pounds each, and it is proposed to have them dropped at the rate of ninety-four times a minute through a 5-inch drop. This mill, for completeness, general plan, and the way it has been set up, was a model at the time; it was, however, not altogether suited to the class of ore to be treated. The ore is basic, having copper, lead, zinc, and gold in gangue. In October of 1909 (?) a severe typhoon raged on this coast and did more or less damage to all the properties. At the San Mauricio mine the head frame was blown down, but no other serious damage was done. The property closed down in 1910.

Other lode properties on which development work has been carried on are the following: Dinaan, north of San Mauricio; the Le Duc property, southwest of Mambulao; and the group of claims known as the Iron King, Gordon, Isla, Guinto, Abe Lincoln, and Navotas, all a short distance east of Tumbaga. All appear to be promising prospects, but nothing is being done on them.

Maliit.—Some 8 kilometers south of Mambulao on Maliit Creek is located the only stamp mill operating to-day in the Paracale-Mambulao district. Messrs. Moisson and Mueller are operating a 10-stamp mill on a 3-meter quartz lode which averages about 16 to 18 pesos per ton. The country rock consists of slate and





Gold veins on the Kelly property

Description of the More Important Properties of the Aroroy District*

The Hayes property.—This property is situated in the extreme southern part of the district. Mr. Hayes, one of the first prospectors in the district, ran some crosscuts in an attempt to intersect the southeastward extension of the main lode of the district, which is locally known as the Bronco lode. No activity on this property is reported in 1921.

The Schwab property.—The next property north of the Hayes claims and on the south side of Boston Hill is being worked intermittently by Mr. Paul Schwab, one of the veteran American prospectors of the Archipelago. Mr. Schwab's mill, a small 1-stamp affair, is not now working. It is claimed that the best free-milling ore in the district is found here.

The Mount Cogran, Tuyo, and Gold Bug properties have all figured more or less in the history of the district, but none is producing at this date.

The Balete and Napuangan, now consolidated under the name of the Argus Mining Company, are two promising groups of claims in the extreme southern end of the district, located on some very fair veins in andesite. A small mill on the Balete property operated for a time, but only development work can be recorded now.

The Keystone Mining Company.—This is the northern most property of the district, located on the north side of Aroroy Mountain. At the present time only development work is being carried on, but a very substantial mill, Chilean using mills instead of stamps, was operated for three years. At present very little of the old plant remains.

The Syndicate Mining Company.—This is the largest producer at present in the district and is the lineal descendant of the old Eastern mine of the early days of the American régime. To the engineer, Mr. T. Uewaki, in charge of surveying and drafting, and the mill superintendent, Mr. Enberg, I am indebted for a map (Plate 35) and the following very complete description of this property and of operations there :

Brief Notes on the Syndicate Mine

The Syndicate Mining Co. is working chiefly three claims on the central part of Karabao Hill reserving the other thirty-one valuable claims.

In the case of the larger properties, I have purposely used information supplied by the officials of the companies. I have personally checked their statements in the field.

The rocks covering the Syndicate area are almost entirely igneous, consisting chiefly of andesites, diorites, and pyroclastics in which numerous gold-bearing veins are found filling fissures. These veins are affected by many faults having nearly east and west or northwesterly courses.

The country rock in the oxidized zone is much altered near the veins ; producing a brown, claylike rock generally showing traces of its original porphyritic structure.

The highest point on the outcrop of champion vein is 650-ft. above the Guinobatan River level, which is generally considered as the permanent water level in this district.

The veins are developed in six levels, and the total length of tunnels exceeds 30,000-ft.

Among twenty-one different veins known, the principal ones that are in mining operation at present are the seven listed below.

1, 2, 3. The Star veins are composed of a very hard, dark blue quartz carrying irregular amounts of manganese and pyrite, the dark color being due to finely divided particles of manganese oxide.

4. The Bin Crosscut vein is of medium hard quartz, containing limonitic mud and manganese oxide.

Name of vein.	Type.	Width.	Known length.	Strike.	Dip to south-west.	Vein filling.	Minerals.
		Feet.	Feet.				
1. Star No. 1	Fissure	5	2,400	North 27° west.	85	Quartz, manganese, calcite.	Gold, silver, pyrite, manganese.
2. Star No. 2	do	4	350	North 30° west.	60	do.	do.
3. Star No. 3	do	6	420	North 40° west.	65	do.	do.
4. Bin Crosscut	do	10	1,700	North and south.	70	do.	do.
5. Nancy No. 1	do	3-20	1,250	North 30° west.	70	do.	do.
6. Nancy No. 2	do	15-65	5,000	North 45° west.	75	do.	do.
7. 89 vein	do	3	350	do.	83	Quartz and manganese.	do.

5. The Nancy No. 1 vein is composed of honeycomb quartz and manganese oxide, forming a well-defined banded structure, and the hardness increases with depth ; it contains much calcite below.

6. The Nancy No. 2 vein which is the biggest one in this district can be traced over 5,000-ft. and the values, as a rule, are found near both walls for a width of 10 to 35-ft. This vein is also composed of quartz, calcite, and manganese oxide, and the calcite content increases with depth.

7. The 89 vein which is a very narrow streak carrying extremely high values is composed of rather softer quartz with a little limonitic mud and manganese oxide, and it contains no calcite.

The ores from these veins are suitable for the cyanide process, containing very fine particles of gold.

The ore is received from the mine by means of a gravity tram with 2½-ton cars and by a mill level adit ; and delivered to a 65-ton storage bin. From this bin it is fed by gravity to a trommel washer with a 40-inch diameter by 16-feet mixing chamber running on tires and rollers and driven by a rope drive through miter gears and spur and pinion on washer at six revolutions per minute. The washer is lined with plain half-inch curved iron plates and has two flights of spirals made of heavy angle iron to promote discharge of the ore. The trommel is slightly conical the same size as washer and 5-ft. long. It is punched with half-inch round tapered holes.

Water is introduced with the ore in the washer partly at the feed end and partly at the discharge as a high-pressure spray thoroughly to wash the ore and free it of clay and slime. The fines discharge is led by a launder to a Dcrr duplex classifier which is set to discharge practically all minus 200-mesh slimes. The sands from this classifier are dragged forward and discharged to the tube mills, entering the regular cyanide circuit. The slimes are led to a storage tank and fed to an 8-foot Senn Batea pan amalgamator running at 175 revolutions per minute with a ½-inch motion. This feature is somewhat of an innovation and was made necessary by the fact that the ore contains an unusually high percentage of clay and slime that prevents it from settling in the thickeners. Before the Senn table was tried the settling and filtering capacity was not nearly equal to the grinding capacity of the mill, the slime at

times requiring over 20 square feet of settling area per ton as compared to about 7 feet for free settling slimes. Since the table has been in operation the settling and filtering capacity is equal to the grinding capacity and has shown an increase of 73 per cent. Extraction on the Senn pan is very low as would be expected due to the very fine state of the gold that passes over the classifier and to the fact that this gold is contained in all the clay and slime washed out of the total ore received. However, only about 10 per cent. of the tonnage passes over the Senn and the heads are very low due to the extremely fine classification; so that the total loss per ton is low and is many times compensated for by the large increase in tonnage and a saving in cyanide and lime necessary per ton milled as well as an increased extraction in the cyanide circuit.

The washed oversize from the washer trommel goes by means of a 16-inch belt conveyor to a storage bin for the crushers, discharging on a 5-foot by 8-foot grizzly with $\frac{3}{4}$ -inch spacings; the oversize going to the crusher bin and the undersize to the ball mill bin. The coarse ore is fed to a 10-inch by 16-inch Blake type crusher set at $1\frac{1}{2}$ inches and running at 230 revolutions per minute. The crusher product goes to a set of 16-inch by 36-inch D. E. W. Co. rolls set at $\frac{3}{4}$ inch; the product from the rolls going by means of a 14-inch belt and bucket elevator to the ball mill storage bin. The elevator discharges into a small grizzly with $\frac{1}{2}$ -inch spacings and the undersize goes by a conveyor belt to a fines storage bin from whence it is fed by a revolving disk feeder to the Abbe tube mill whenever the load of sand will permit.

From the ball mill bin the ore is fed by means of a 30-inch revolving disk feeder to a 16-inch by 6-foot Hardinge ball mill running at 25 revolutions per minute; sufficient solution being introduced for dilution to about 30 per cent. moisture. The ball mill discharge, all of which is minus $\frac{1}{4}$ -inch mesh, is elevated by means of Frenier sand pumps (10-inch by 54-inch) to two Dorr duplex classifiers, the slimes going to two 30-foot Dorr thickeners and the sands going to one 60-inch by 6-foot Hardinge pebble mill and one 6-foot by 16-foot Abbe tube mill. The discharge of these two mills is elevated by the Frenier pumps to the two Dorr classifiers, and the classifiers return the sands to the mills and the slimes to the thickeners.

From the thickeners the thickened pulp is conveyed by diaphragm pumps to three 30-foot Dorr type agitators placed in series. The pulp from the final agitator goes to three Kelly type filters. The filters are loaded by a 6-inch Byron Jackson sand pump and the cake formed in from seven to ten minutes by means of a montejeu and an air compressor at 45 pounds pressure. After the cake is formed, the excess pulp is returned to the agitator and barren solution introduced into the filters from a storage tank through a 5-inch Goulds centrifugal pump at 35 pounds pressure for a period varying from thirty to sixty minutes and dependent on the tonnage being handled. After the barren wash, water is introduced and a wash of two to five minutes used. The filters are then run out and the cake sluiced to waste. The filter cycle ordinarily takes two hours.

The total effluent solution from the filters is pumped by a low speed centrifugal to No. 6 thickener and clarified by settling, thence it goes to the mill solution pump and is elevated by a 7-inch by 8-inch Goulds triplex pump to the mill solution tank, forming the solution used in the grinding and classifier circuit.

The clear overflow from the thickeners goes to a 15-foot fiber clarifier, thence to a 15-foot sand clarifier, and thence to five 6-compartment zinc boxes where the values are precipitated. The barren solution from the zinc boxes is elevated by a 7-inch by 8-inch Goulds triplex pump to a barren-solution storage tank at the head of the mill whence it returns to the filters for the barren-solution wash.

The zinc boxes are cleaned and dressed weekly, and the resulting shorts and precipitates are roasted and dried; fluxed and smelted in a No. 275 "Case" tilting furnace and the bullion shipped to Manila offices.

The present capacity of the mill under proper operating conditions is about 200 tons per 24-hour day. Owing to extreme variations in cost of materials and supplies no milling costs can be given as they are so variable as to be of no value.

Power is furnished by two 150-horsepower Mirreles Diesel engines and one 165-horsepower Busch-Sulzer engine: all direct connected to direct-current generators, generating current at 110 volts. Motors are used for all drives and the average power consumption at present, including one 35-horse power aircompressor making air for the mine, is from 2,000 to 2,100 amperes.

The Colorado Mining Company.—The Colorado mine was discovered, very soon after the American occupation, by Mr. Herbert, and ore from it has been milled fairly continuously since 1911 until it closed down this year (1922). To Mr. Lloyd Robert, the superintendent, I am indebted for the following description of this property:

The Colorado mine exploits a number of lodes on Bagadilla Mountain, of which No. 5, Sub 2, 8, and 9 are the most important. All of these are parallel in strike, and all except the Sub 2 in dip. Sub 2 vein dips in the opposite direction.

In addition to these, there are a number of veins intersecting No. 5 vein, and usually called split veins. Of these the 7 Split, the Split vein, and the Tabios Split are the most important. These, in general, carry narrow veins of higher-grade ore.

No. 5 vein has been the most important of all veins and has been opened for a length of 2,300 feet and depth of 800 feet. In places it has had widths of 30 feet in pay ore.

All the main lodes are cut by a fault which has a right-hand throw of 65 feet. A number of parallel smaller faults are known but the dislocation in these is small.

The vein filling is quartz, in parts carrying considerably manganese. Practically no other metals occur, and no sulphides are found. The gold is rarely visible, and the ore is not free milling in any profitable percentage. It is, however, readily amenable to cyanide treatment. The values are extremely spotty but the range is not great, anything over 50 dollars being exceptional.

The ore is passed over a grizzly with 2-inch opening and oversize is crushed and stamped in three batteries, of 1,250-pound stamps. The crushed product, together with the grizzly undersize, passes to a ball mill, 5-ft. by 6-ft., and thence to two tube mills in close circuit with two Dorr classifiers. The undersize from the classifiers, of which about 90 per cent. will pass a 100-mesh screen, goes to a Dorr thickener, 14-ft. by 28-ft. The thickened pulp goes to two Pachucas in series and thence to an 81-leaf Butters filter. The overflow from the thickener is passed into two more Dorr thickeners which act as settlers for the almost clear solution, and they, in turn, overflow to a small sand filter clarifier and thence to the zinc box supply or gold tank. An average of 350 tons of solution is precipitated per day.

Cyanide consumption averages 0.65 of a pound per ton, and zinc about the same. Lime, 15 pounds per ton; strength of solution 1.5 pounds per ton, KCN, and 1.3, CaO. Tube mills use mine rock, and require 20 to 30 pounds of rock per ton of ore. Ball consumption 2 pounds per ton.

Accurate drip samples are taken of zinc-box flow, and flow is measured by a Bristol recording gauge. Heads are calculated from the value precipitated per ton and the filter tails. They are partially checked by a rough and unsatisfactory sample taken above the batteries.

Many improvements have been made in this district in late years; chief among them are a new road from Aroroy to the southernmost large mill, the Syndicate, and a branch from this road to San Agustin Bay, where landings have been made for the Colorado and Syndicate properties. There is now an excellent steel bridge over Lanang River, as well as a schoolhouse on the Colorado property for the children of the mining population. There are also churches and cinematograph halls. Boats between Manila and Aroroy ply with greater regularity than formerly, and there is telephone and telegraphic communication. The district seems to be in excellent condition, and prospects are very promising for successful operations on some of the properties for some years to come. There are many veins on the properties of the two operating companies, as yet unprospected, which may prove to be of workable value.

The Baguio District

The heart of the Baguio mining district (Plate 15) is situated less than 8 kilometers east of the former summer capital of the Philippines, from which it gets its name. It lies about 270 kilometers almost due north of Manila near the southern end of the great Cordillera Central. The elevation varies from 900 meters at Antamok to over 1,500 meters on the surrounding mountain tops.

A railroad has been projected to connect Aringay and Baguio; some of the grading has been done; from Baguio wagon roads will terminate at the several properties. At present there is an automobile road about 14.5 kilometers up Bued River Cañon from Damortis, near the northern terminus of the Manila Railroad.

This is a region of high relief and great erosion due to torrential precipitation. Pine is the dominant tree, but it is growing scarce in the vicinity of the mines.

Water is the chief source of power, but larger installations are needed than are available at present.

American miners have been prospecting in this district for fifteen years, but only during the years 1908 to 1911 and 1915 to 1921 has successful mining been carried on by organized companies. In 1909, there was a severe typhoon, which wrecked the Benguet Consolidated mill, and in 1911 the district suffered other setbacks, so that there was practically no production from 1911 to 1915. One 3-stamp mill continued milling rather steadily throughout much of that interval, and in 1914 the Benguet Consolidated Company rehabilitated its plant and is to-day operating very successfully. Several of the properties that were once well known in the district and gave some promise of realizing a future, have for the time being at least become negligible features. These are the Acupan, the Bua, the Major, and the Headwaters. Other prospects, such as the Muyot and the Kelly groups, are expected to become mines some day; but so far only development work has been done on them. Others, from which some people have hopes of realizing fortunes, will probably never come to fruition.

Prior to American occupation, the veins of this district had been worked by Igorots, Filipinos from neighboring provinces, and Chinese. Some of the old workings are rather extensive and have been of great help to prospectors in locating veins. They are similar to the workings found in other parts of the Islands where only the rich stringers were gouged out and are, consequently, so narrow that an American would find it almost impossible to go through them. One of the drifts in the Kelly mine cut an old Igorot stope filled with waste that had become cemented as hard as the wall rock.

Geology.—The geology of this district, has been described by Eveland, (237) by Eddingfield and Smith, (603) and by Dickerson. The last-named author deals largely with physiography. Eveland was the first to make a systematic geologic reconnaissance of this region, and the essential results of that survey have been corroborated by later work.

The principal formations in the Baguio district are quartz-diorite and granite intrusives, some Tertiary sediments, andesite flows, tuffs, and agglomerates. The oldest sedimentary formations in this area appear to be the Vigo group, conglomerates, sandstone, shales, and limestone of middle Miocene, which are exposed at places well down in Bued River Cañon, and in Major and Copper King Creeks. These are cut by both andesitic and quartz-diorite intrusions, and in the southeast end of the area the latter is cut by a hornblende granite. Above the whole, stratigraphically, and in some places actually superimposed and in contact, is the later andesite consisting of solid and agglomeratic flows. In the western part there is, overlying all of the foregoing, the Malumbang limestone of Pliocene age. Following the folding and intrusions, which began probably with the Miocene but which culminated toward the close of the Miocene and continued into the Pliocene, extensive mineralization and vein filling took place with quartz, calcite, and manganese as the chief gangue minerals, carrying gold and silver with, possibly, some tellurium, and small amounts of mercury in some places. This deposition of silica and calcite continued through the Pleistocene, and has not altogether ceased even now. This region, like most parts of the Archipelago, is profoundly faulted and fissured. Not only were all the fissures of the country filled, but much of the overlying andesite and tuff were silicified by the siliceous solutions, giving rise to the especially characteristic Baguio formation which is well shown near Government Center in Baguio City.

The Benguet Consolidated.—The Benguet Consolidated mine (Plate 33) is the richest gold mine in the Orient. It is located in Antamok Valley, about 12 kilometers southeast of Baguio. To the president, Mr. A. W. Beam; the superintendent, Mr. O. L. Kettenbach, and Mr. M. F. Dodd I am indebted for the following information about the property and its history:

In 1902, Mr. H. Clay Clyde discovered this bonanza. Like the majority of discoverers of payable mines, however, Mr. Clyde realized almost nothing from his find. He, together with Messrs. M. A. Clarke and Nels Peterson, organized the Benguet Consolidated Mining Company a year later. The first plant, which consisted of three stamps, amalgamating plate, and leaching tanks, with a capacity of 25 tons per day, was erected by Mr. Clyde M. Eye, E. M., in 1905. Gradual additions were made to the plant so that, four years later, the company boasted of six stamps and sufficient additional equipment to increase the handling capacity of the plant to 40 and 50 tons of ore per day.

In 1909, the flood at Antamok, Benguet Province, where the mines are located, destroyed the cyaniding portion of the plant. Mr. Nels Peterson repaired and placed in commission the milling section of the plant the following year, and it was operated by him until the latter part of 1911, when the remaining portion of the plant was swept away by flood.

For the purpose of building a modern, up-to-date milling and cyaniding plant with a capacity of 50 to 60 tons per day, sufficient capital was raised locally during 1914, and Mr. Eye returned to supervise its erection and to remain as operator. Since the erection of the present plant, the operations of the Benguet Consolidated Mining Company have been very successful. The handling capacity of the plant is now from 120 to 130 tons of ore per day. Shareholders in the Benguet Consolidated receive regular quarterly dividends of 50,000 pesos and an additional 50,000 pesos in July and January of each year.

The developments underground are now so satisfactory that plans are under way to enlarge the plant so that it can handle 175 tons per day. Production will then increase to 1,500,000 pesos per year. Over 1,000,000 pesos worth of gold bullion was produced by the Benguet Consolidated in 1920.

The Benguet Consolidated Mining Company is a *sociedad anónima* organized under the laws of the Philippine Islands in 1903. The present capital of the company is 700,000 pesos, Philippine currency, divided into one million shares of a par value of 70 centavos each. The original capital of the company was 1,000,000 dollars, but this was reduced to 1,000,000 pesos in 1916, and on March 25, 1921, the capital was further reduced to 700,000.

The company owns approximately 420 acres of mineral-bearing land, of which 285 acres are held under patent, and 135 acres under location. Its holdings cover about 8,000-ft. along the strike of the main Benguet lode.

From the commencement of operations in 1906, until the end of 1920 we have mined and treated 143,793 tons of ore, of an average value of 38.50 pesos per ton, at a saving of 90 per cent. of the gold and silver content, or a total saving of 4,983,750.62 pesos, Philippine currency. During 1920 we treated 35,565 tons of ore at a production of 1,068,892.30 pesos, Philippine currency, and a net profit of 456,668.58 pesos.

Total dividends paid to the end of 1920 amount to 1,250,000 pesos.

Estimate of ore reserves, January 1, 1921.

		Tons.	Pesos.
Positive	.. .. .	27,100	860,000
Probable	.. .. .	38,810	1,417,840
Possible, exposed incompletely on one side	.. .. .	67,000	2,370,000
Total	.. .. .	132,910	4,647,840

Since the foregoing ore estimate was made we have cut the foot wall vein on Level "C," thus bringing into the "possible" column a large tonnage of ore not counted in the estimate.

In connection with the ore estimate it is interesting to note the production from Level "B," which is approximately 120-ft. on the dip below Level "A." Exclusive of ore taken from Level "B" through the old mine, the amount of which was considerable but unknown, Level "B" has produced 59,212 tons, and still contains in positive, probable, and possible ore 42,910 tons, or a total for this level of 102,122 tons. The pay chute opened up on Level "B" is more than 1,400-ft. long, with high values in the face of the drift west on the hanging wall vein. This drift has been discontinued for the reason that it is near Antamok Creek and not far enough below the creek to make it safe to continue.

The ore is a mixture of quartz, iron sulphide, altered diorite, and clay, with quartz predominating. Although a very small percentage of the gold is free none is visible. The ore treatment consists of crushing, stamping in cyanide solution, grinding in pebble mills to pass 100-mesh, and a nine-day cyanide treatment. The pulp is passed through an Oliver filter before final discharge.

Electricity is used for power and lighting. It is furnished by two small hydro-electric plants having a combined capacity of 375 K. V. A.

The geology of the mine, as described by our mine superintendent, Mr. O. L. Kettenbach, in his last annual report, is as follows:

"The main Consolidated vein is formed by two main fault fissures and a third series of adjustment cracks, formed, I believe,

with one exception, contemporaneously with the second of these main fissures.

"In the first two fissures were deposited the main hanging wall and foot wall veins. Of these two the hanging wall vein is by far the older, non-mineralized inclusions being practically absent within it while abundant in the foot wall vein. The fault movements producing both fissures were intense, as is evidenced by the cleanly defined hanging wall of one and foot wall of the other, together with the abundance of clay selvage on both and the intensity of slicken siding which is occasionally seen.

"The advent of the footwall fault in such close proximity to the hanging wall fault created a zone of weakness beginning at the former and extending to the latter. Adjustment cracks and planes always follow major fault movements and I take the numerous cross veins in the mine to have been formed in cracks or secondary fissures caused by these movements.

"These two fault systems are by no means parallel, and the mineralized solutions working along each produced, first, a zone of enriched ore in close proximity to each fault plane, and, secondly penetrated the brecciated mass lying between the two and mineralized it in a ratio varying directly with the distance separating the two fissures.

"The remarkable persistence of values, both laterally and vertically, particularly in the hanging wall fissures, leads one to the belief that the mineralizing solutions were at least fairly deep seated and abundant in their supply."

At present (March, 1921) the company is driving a 3,500-foot drift along the hanging wall of the lead, the entrance to this being in Antamok Cañon to the east of the present workings about 3,500-ft. This is primarily intended for drainage, but it will also be used thoroughly to prospect the lead by means of crosscuts and raises run from it at regular intervals. The old native workings, known as the "Fianza gold mine," are included in the ground to be explored by this drift.

The old mill and the process as used at the Benguet Consolidated mine have been fully described.* The flow sheets for the present mill are shown in figs. 21 and 22. The capacity of the new mill is 250 tons daily. The crushers are Joshua Hendy Hercules type 8 inches by 12 inches. Their individual capacity is 100 tons daily of coarse rock to 1 inch. Ball and ball-pebble mills are of Allis Chalmers make. The former reduces 175 tons daily of 1 inch feed to 3/16 inch product. The latter reduces 60 tons of about 3/8 inch feed to sand. Stamps are Joshua Hendy make. They weigh 1,050 pounds each and drop 106 times per minute. They are run intermittently only. Their full-time capacity is 50 tons of 1.5-inch feed through a 0.5-inch screen. The tube mills are of Denver Engineering Works make. Combined they reduce about 100 tons daily from 3/16-inch feed to 92 per cent 100-mesh discharge. The Crowe process and precipitating machinery is by the Merrill Metallurgical Co. Its capacity is 600 tons solution daily. Thickening and agitating machinery is of Dorr Co. make. Filters are made by Oliver.

The Bua Mine.—This property is situated just across the river from and below the Benguet Consolidated mine.

In 1909 this mine and mill were in full swing and gave promise of becoming a real producer, but since the typhoon of October, 1909, the property has not been operated. The Bua property before it closed down was working two veins at Gomok, one a quartz vein from 1/2 to 1 meter in width, the other a rhodochrosite vein 1 to 2 meters wide striking north 10 degree east and dipping 65 degree to the south. There were several hundred meters of underground workings in this mine and a well-equipped mill. At the present time everything has been abandoned.

¶ *The Headwaters Mine.*—The Headwaters property on the upper Antamok had a fairly elaborate equipment, consisting of stamps, tube mills, Pachucas, and a Ridgeway filter; unfortunately it had three serious handicaps; namely, insufficient ore, very little timber, and lack of cheap power. The failure of this company gave a severe setback to the district. At the close of 1921 development work was resumed on this property.

The Camote-Clayton.—The Camote, adjoining the Benguet Consolidated property on the southeast, is one of the largest ore deposits in the district and seems to be a continuation of the Minnesota lode, on which the Benguet Consolidated mine is located, as well as of the well-known Fianza ore body between the two. The vein where it is opened on the Camote property is manganese and calcite and is said to average about 8 meters in width. A large amount of ore

has been developed and between 500 and 600 meters of workings have been driven. This ore is said to "catch 6.50 dollars on the plates alone." Mr Reavis operated a small mill here for a time, but this has been abandoned.

The Kelly group.—The late J. E. Kelly developed through a long period of years a group of claims near the head of Gold Creek, just west of the Benguet Consolidated property. This group on the north slope has four veins: No. 1 particularly shows as a strong high dike on the bank of a stream; No. 2, North 60 degree west, dipping 60 degree to the north; No. 3, south 60 degree west; and No. 4, north 34 degree west; the outcrops of these veins are well marked. Considerably more than 1,000 meters of drifting and crosscutting has been done on the veins which vary in width from 1 to 3 meters. The values, while encouraging in spots, are not consistent. The ore carries no free gold, but has more or less telluride. On the south slope Mr. Kelly had cut four more veins with from 500 to 1,000 meters of workings. These veins generally run east and west and vary from 0.6 to 10 meters in width (fig. 23). About half the gold in this group is free milling. These properties might be worked in consolidation with others, but alone they present some difficulties.

Other groups are the Major, Lorenzo Pau, Antamok Valley, and Muyot. As most of these are on veins which cut the upper andesite, they will probably never prove as valuable as those located on or near the contact of the quartz diorite and older andesite of Antamok Valley.

Acupan.—There is a group of claims located north of the barrio of Acupan, on Batwaan and adjacent creeks, which have been developed for some years. During 1915 and 1916 there was a small 3-stamp mill operating, but this has since been shut down.

I examined this property very recently (June, 1922) and do not hesitate to say that it is at present the most promising and nearest to development of any of the properties in the district not now operating. Besides a considerable amount of ore already developed, its main vein, a true fissure vein in the diorite, promises to be persistent and to yield good values with depth. Fair power can be readily available. The tenor of the ore is about 16 pesos in the body above water level. It should improve with depth.

Demonstration.—This mine is located on the old Copper King group of claims and is being developed under the direction of Mr. H. P. Whitmarsh. There are two veins which lie close to the contact of andesite with Tertiary sedimentaries. One of them is a quartz-calcite-manganese vein, and the other is refractory, carrying copper, lead, and zinc. A 5-stamp demonstration mill has operated for a time on this property; hence the name.

The Ascension group.—Nothing further has been done on this group since the regrettable murder of Mr. Calvin Horr by an Igorot, in 1918.

The Magma.—On Duglay Creek, in the extreme southeastern corner of the Baguio district, about 1 kilometer from the barrio of Acupan, is one of the largest bodies of quartz I have seen anywhere in the Philippines. Unlike most of the veins in this district, this one strikes nearly due north and south and dips to the east. Mr. H. P. Whitmarsh, who has for so long been a prominent figure in Benguet mining, is developing this property and reports very encouraging assays. Mr. J. D. Highsmith discovered the lode. The country rock is quartz-diorite, which a later granite has intruded. The property gives every promise of a bright future.

Other Districts

Palidan Slide, Suyoc.—This is an enormous slide in more or less soft, decomposed, mineralized diorite and andesite which the Igorots have panned for gold for years untold (Plate 21). Several Americans have from time to time worked the stringers in this slide, and for a time Mr. Gillies treated the ore in an arrastre.

Igorots are reported to have taken out from 40,000 to 80,000 pesos worth of gold in a single season. The method is similar to that employed in other countries, and is known as "booming."

Several quartz veins, none very wide, are being developed at several places near Suyoc, the best looking of which appears to be the one at Dugong, about 3 kilometers west of Suyoc. I secured some exceptionally rich hand specimens in May, 1922.

Binalonan, Pangasinan.—Mr. Geo. Mentzer has operated a small stamp mill intermittently in this locality for some years, but with only nominal success.

Placers

The principal gold-bearing alluvial areas in the Archipelago are Paracale and adjacent rivers from which the cream has been taken, on the north coast of Camarines Norte, and the east coast of Mindanao near Lianga. The last-named areas are being dredged, or preparations to dredge are being made, at the present time.

On Binabay River, Mindoro, some gold placers have been prospected from time to time with indifferent results.

In past years there have been attempts, some successful, many not so, either to dredge or to sluice along Iponan and Cagayan Rivers in Misamis, along the Cansuran in northeastern Mindanao, along Lanang River in Masbate, along Agno River in Pangasinan, in Nueva Ecija, and at several points on the east coast of Luzon.

Placer types.—Philippine placers are of two general classes; namely, high-level, or bench; and low-level, or those in the valley bottoms, whether occupied by running water or not. No beach placers, as far as I know, exist in the Philippines.

Origin.—Philippine placers, like placers in other parts of the world, have originated from the erosion of lodes some where on higher ground, either near or distant.

Age.—All the placers that have been dredged in the Philippines are, without much doubt, the result of erosion since the last great uplift in the Archipelago; that is, since the Pleistocene.

Values.—In the early days of the boom in Paracale, about 1910, some ground was found to run as high as 2 pesos per yard, while the average was 25 centavos.

Placer districts.—In addition to the placer areas already mentioned in connection with Paracale and Aroroy districts, the following more or less well-known fields either have been prominent in the past or promise to merit some serious interest in the near future:

Near Peñaranda, Nueva Ecija.

Umirey River, east coast of Luzon.

Cagayan and Iponan Rivers, Misamis, northern Mindanao.

Cansuran River, northeast Mindanao.

Lianga, east coast, Mindanao.

Binabay River, Mindoro.

Placer, Surigao, Mindanao.

Curuon, Zamboanga Peninsula, Mindanao.

Of these only the Lianga is being worked on an up-to-date scale to-day.

Peñaranda.—The gold placers of Nueva Ecija have not received much attention, although they have been known and worked for sixty years or more by foreign capital.

It is reported that a Spaniard, fifty years ago, worked placer ground at a point about halfway between Cabu and Peñaranda on the Sapang Bujoy. A map of Luzon, by d'Almonte, published in 1883, has marked upon it six points in this district where gold had been found, one on the Sapang Bujoy, two on the Macabacay, two near the junction of the Rio Chico and the Sumagbac, and one near the head of Santor or Cornell River.

An Englishman about 1890 did some work near the head of Cabu River at Bakas. At that time also, a company was formed in Manila which started work on the Macabacay with a crude sluice. Its operations were terminated by the insurrection of 1896 and no more work was done until Mr. Dorr, who had been employed by this company, resumed work in 1905.

No other records of work done by white men previous to 1909 could be found; but Filipinos have worked the gravels for ages by hand panning and hundreds of them at present have no other occupation.

A number of men from Manila formed a company in 1909 and located claims on almost every stream between Cabu and Gapang. They tested the ground near Peñaranda with a boring machine. These boring tests were reported as showing 33 centavos per cubic yard. Pan tests in other localities gave much higher values, ranging from 50 centavos to 1 peso. Such ground when worked on a suitable scale will give good returns on the money invested.

One of the most interesting features in all parts of this region is the presence of platinum in small quantities. Filipinos were ignorant of its value and always threw it away when they separated it in their pans. It is probable that iridium or other rare metals may also be found, as stated by Goodman. The only other region in the Philippines where platinum has been encountered is at a point about 64 kilometers south of the Nueva Ecija district, and the indications are that both deposits are derived from the same source.

The gold is bright yellow and is reported to be 958 fine. It occurs almost invariably in thin disks or flakes, varying in size from a fine dust to rare fragments as large as a 10-centavo piece; it averages about 0.5 centimeter in diameter. This would lead to the assumption that the gold came from a schist or gneiss, or a much-squeezed quartz vein. The only rock of this character so far reported in this region is the gneiss mentioned by Goodman, but extensive exploration has never been made.

The area in which paying amounts of gold can be found is very large, extending from the eastern cordillera to the Rio Grande de Pampanga, between Santor River and a line 8.4 kilometers south of the Rio Chico, about 1,550 square kilometers. There is a bed of sand and gravel which seems to cover this entire area, possibly produced by constantly shifting streams. This explanation of the origin seems more probable because of the great number of streams which seem to head from about the same source in the eastern cordillera, all of which carry gold even to their mouths. These streams are the Rio Chico, Ilog Munti, Sapang Palanao, Cornell or Santor, Mayon, Macabacay, Pagsanjan, Calabasa, and Cabu, which flow into the Rio Grande.

Umirey River.—For notes on this field we are indebted to Judge Frank B. Ingersoll, who has been prominent in dredging circles for many years in the Philippines.

This is a region almost entirely unexplored during the Spanish régime. It has only been within the last ten or twelve years that it has been invaded by the American prospector. Unlike most of the gold-bearing districts of the Philippine Islands, the native inhabitants in this region know practically nothing about even the most primitive kind of mining. In most localities of the Archipelago where gold is found the natives know its value and how to win it from the rock or the alluvial dirt. Many of them, particularly the women, are very skillful panners. Along the Umirey and its tributaries there are never seen either wooden *pabirics*—so well known elsewhere—or any other gold-saving devices.

The people are very primitive in their habits. Up to the last few years they had no fixed habitations and depended for food on fishing, hunting, and trapping. Of very recent years a few of them, under the tutelage of the American prospector, have settled down, built houses, and are cultivating a few crops.

The people are called Damagats (?). Most of them are tall and powerfully built, being capable of "packing" tremendous loads over the mountains. They are reputed to be the descendants of Spanish residents of a penal colony who mated with diminutive Negritos, from which alliance come their "kinky" hair and dark complexion.

Up to the advent of the American prospector about 1911, most of these people had never seen money and the "cargadores" (packers) were paid in red cloth, beads, small mirrors, salt, etc. This occurred in a district not much over 30 miles from Manila in an air line.

So far as it is known for gold possibilities the district is located in the two provinces of Rizal and Tayabas. The Angelo River, which is a branch of the Umirey, rises in the northeastern part of the Province of Rizal near Mount Angelo. This is in the sierra which divides the Pacific slope from the rest of the Island of Luzon. The Angelo is a branch of the Umirey, which latter empties into the Pacific Ocean at Dingalan Bay about 80 miles to the north of the port of Mauban.

The Angelo and the upper part of the Umirey run through extremely rough country and the current is very swift in most places. Here and there level stretches are encountered where there are flats suitable for dredging. This condition obtains for about 35 miles. Over much of the distance there is little but exposed and barren bed rock. At one place the Umirey River disappears from view and runs underground for a distance of about three miles. Shortly before reaching the comparatively low lands through which the Umirey runs for about 18 miles before reaching the sea, the river descends through a succession of cataracts. Here the country is so rough that it is with great difficulty that an ascent can be made on foot and the cost of a road would be prohibitive.

For a number of years, the Luzon Gold Company, a Philippine corporation, has had large placer holdings along the Angelo and the upper reaches of the Umirey. In places there are most excellent showings and as a rule the gold found in the streams is coarse. At one place there are large flats, physically well-suited for dredging, with an estimated goldbearing area of about 600 or 700 acres. At other places the ground is suitable for hydraulicking and still again

for ground sluicing. As yet there have been no discoveries of veins.

In 1912 a small sluicing plant was installed on the ground below the cataracts of Umirey River, but this was swept away by a freshet and the gold in the sluice boxes, estimated to be worth about 10,000 pesos, was lost.

The dredging ground mentioned has had considerable testing and its owners estimate very high values, but to bring in the necessary plant would require the building of a road through the mountains for a distance of about 48 kilometers from the town of Montalban, Rizal Province, which is about 32 kilometers distant by rail from Manila.

On the lower Umirey River, Messrs. Squires Brothers, of Manila, have a number of dredging claims. Several years ago, an Australian company, Umirey Gold, Ltd., built a dredge near the mouth of the river and, partly by flotation and partly by digging a channel, worked its way up the river for some 24 kilometers to the Squires Brothers's claims which had been taken under a working lease.

There has been a great deal of discussion regarding the adaptability of this dredge to the conditions encountered and the methods used in attempting to win gold. At all events the venture was unsuccessful, and the dredge was finally dismantled and moved to the Lianga district in Mindanao.

Cagayan de Misamis, etc.—Enrique Abella(1) published a lengthy account of this district as early as 1877. A translation of his Spanish report will be found in the Mineral Resources for 1909. In 1908 Ickis (335) made a survey of portions of the same country.

The principal workings of the people of Misamis were located along the Iponan and Cagayan, near Pigtao on the former and Manigue on the latter stream. The placers are of two general types; the high-level, or bench, placers of greater age, and those of the more-recent river bottom. Ickis was of the opinion that in spite of the values in gold which the Filipinos had recovered from these streams modern dredging or large-scale sluicing in these localities would hardly pay; but over the divide, on the headwaters of the Pulangi to the southeast, he found extensive gravel beds which yielded such encouraging panning tests that he recommended further exploration with drills.

The gold in this region, like much of that in northeastern Mindanao, is clearly derived from quartz veinlets in schists. Accompanying these schists in this region are some old slates, which may be of Mesozoic age.

The following paragraphs are excerpts from a translation of Abella's description of these early workings, particularly of the bench placers:

Not all the gold is won from the sands of the river bottom, and they have recourse to them, as I have already indicated, only in the dry season, during which the bench placers within the limits of the hydrogeologic basin of Iponan River cannot be worked.

Situation.—From the village of San Simon, where the valley walls are higher and more confined by rounded hills, the river receives as one goes upstream a great number of tributaries which cross many alluvial and auriferous spots and also unimportant arroyos. For example, following the river upward, there is, on the left, the small valley of Pasayanan, with indications of scattered and ancient workings; then, on the right, the richest, that of Batinay, which moreover is of greater extent; then that of Dominolog with recent workings of a less-primitive character; and continuing, those of Babantohon, Pigsagan, Dumalogdog, and the famous Pigtao, the locality where the most remote Christian settlement, now withdrawn to Tagsulip, was established; and finally, Camingañan, Cayomangon, Saganahai, Tapbagbag, and Taculut, almost within the territory of the Moros.

Continuity.—The placers are not all situated on the same level as the waters of Iponan River, but at a certain altitude above them, not exceeding as a rule 20 meters, and in elevated parts of the lateral branches, though never very far from the principal river, demonstrating that the origin of the placers bears a definite relation to the ancient bed of the stream. This bed, formerly very much wider than the present one, has suffered with time from the effects of partial denudation which has eroded the once continuous capping of the alluvions, resulting in the present discontinuity and isolation of the localities.

General character of the placers (alluvions).—The general character of the alluvions is uniform. Essentially argillaceous throughout, it is in the upper part composed of a very sticky clay, reddish, and containing very small rounded pebbles, fragments of old slates

of various classes, which become more numerous and larger as one goes deeper, the clay which envelops them being usually whiter, more sandy and not so compact, and containing pebbles (cantos) of eruptive rocks, others of magnetic iron or hematite, which the natives call *tonase*. The abundance and size of these pebbles are considered a sure indication of the richness of the placer. The gold is not confined exclusively to the portion in which the pebbles are found, since in the uppermost layer of the alluvion gold dust begins to be encountered, although rather scattered; but, notwithstanding this dispersion of the gold, most of the metal, the greater richness, is always found near the bed rock. The depth of one of these placers never exceeds seven meters in those places where it has its greatest area, nor does it become less than a meter in the smaller areas, this difference being due to the subsequent denudation to which I have alluded above. In those spots where this process has had little effect and where the alluvions are intact, the natives distinguish in them various horizons which really correspond to the changes of composition and appearance I have already pointed out, and distinction and classification of which reveal a very exact knowledge of the structure of placers, remarkable in a race so primitive and backward. This classification from above downward is as follows:

Payason.—Clay, more or less dark, which lies immediately below the vegetation.

Acaron.—Red clay, very sticky, with small pebbles, generally slaty and semidecomposed (*batóng patay*—dead rock, literally).

Dugcálon.—Yellow clay, more sandy, less sticky, with pebbles of quartz and eruptive rocks, some of great size, others smaller of hematite or magnetite (*tonasé*) with the maximum richness of gold.

Dapanás.—The bed rock is marl, limestone, or conglomerate.

However, these divisions are not all present in the placers, since there are spots, as I have indicated above, where the eroding action of the water has removed some of the upper layers, leaving parts of those below, and because of its richness the natives work the ground with profit in spite of the small thickness.

As for the distribution of values in the placers in the same horizon, that is to say, within the zone of richness, *dugcálon*, it is not uniform nor can it be, if one recalls the circumstances attending its formation.

Those places in which particularly rich values were encountered are called by the natives, the *Monteses* as well as the Visayas, *topadas*, a good Spanish word, and this seems to indicate that Spaniards, probably coming from Mexico, may have once worked these placers.

Method employed in the district for the recovery of the gold.—The method is in reality the same as that employed by the natives throughout the Islands for working the placers, and though quite simple it is very similar to that used even to this day in other countries, and reveals a certain knowledge of the rudimentary principles of mechanics which seems to corroborate the hypothesis of former Spanish work.

To summarize, this proceeding has four phases distinct as to order and object: (1) *Investigation* of the deposit by means of *tujubs*, not always necessary, as, for example, when by other indications or by known signs they know beforehand that the placer is rich in the part they expect to work; (2) *preparation* for the work by the construction of a canal, reservoir, and all the other work; (3) *concentration* of the alluvial ground or the exploitation proper of the deposit, by means of the work in the *banlasan*; and (4) the *cleaning up* (*depuración*) of the sands by hand washing with the *bilingan*, finally obtaining the gold free. Each one of these phases represents quite different amounts of work; the first, as I have just indicated, is sometimes dispensed with; the second, undoubtedly, is the most laborious of all; the third, it can almost be said, works of itself; and the fourth, though quite tedious, has to do with small amounts of material and constitutes only a very small fraction of the work.

In Iponan River Valley the following placers are the best known: Pasayanan, Batinan, Dominolog, Pigtao on the Iponan, and Bitog Calao on Cagayan River. Along Cutman and Bigaan Rivers there are similar placers. The average of several of these deposits would be, according to the figures of Abella, about 3 grams per cubic meter. The following paragraphs are from Edgingfield's notes (217) on the Cansuran district:

Cansuran River.—The Cansuran Mining district is located about 10 kilometers south of Surigao, Mindanao, near the center of the Peninsula of Surigao. The district extends from a little beyond

Mounts Canmajat and Binutong northeasterly to the Surigao River, comprising principally the area between Biga and Tungunaan Rivers which flow into the Surigao.

It is said that over thirty years ago an Englishman operated in the district for a short time. About the year 1885 a Spaniard, Ricardo Gonzales, obtained a concession by which he controlled all the water rights of the district. He did no mining himself, but granted water rights to the natives for 25 per cent. of the gold produced, with the privilege of buying at a very low figure all of the gold which they obtained. Since that time the natives have worked whenever sufficient water could be obtained for sluicing.

The country between Surigao and the point where the Cansuran Creek enters the Biga is a wide cultivated valley. A road is in use for 4 or 5 kilometers south of Surigao and is at present being extended; beyond this point, a trail, at places difficult for a horse, leads to the gold district. The Surigao River is too shallow in many places to permit the easy passage of large *bancas* beyond the point to which the road has been built.

The country between the Biga and the Tugunaan is very precipitous and hilly. The rivers and streams have cut deep channels through the country leaving steep slopes. The central portion northeast of Longong is comparatively flat, forming a plateau which slopes gradually toward the Surigao River. Southwest and west of Longong, however, prominent hills with steep sides make up the country.

The gold occurs as placer and is unusually coarse for the Philippine Islands; many nuggets have been found weighing over 30 grams each. The great majority of the gold as brought in by the native workmen would not pass a 30-mesh screen and a large amount would be caught on a 10-mesh screen. The grains are for the most part well rounded showing considerable movement, except on Tagbasingan and Canmajat Mountains where crystallized gold, often wire gold, is found which apparently has not been moved far. The workings on Canmajat are said to be in quartz and the gold to be panned from crushed rock taken from a vein which cuts across Canmajat, striking almost north and south. The average gold in the district runs about 790 fine in gold and 200 in silver.

The gold in the southwestern part of the property, that portion which is made up of high hills and ridges, is found in gravel beds from 3 to 10 meters thick. These beds cover the hills and ridges almost uniformly and have the appearance of being deposited by one or more old rivers. They are made up of coarse and fine gravels. Boulders weighing several tons are common, and boulders weighing from 10 to 100 kilograms each are very abundant. Most of these, probably 90 per cent., are andesite, others are schist, diorite, and red felsite. In the northwestern part along the Cansuran River some quartz pebbles were found, but the greatest part of the deposit contained no quartz pebbles of any size. The bed rock consists of shales more or less slaty in character and schists in which are numerous quartz stringers carrying free gold.

The Surigao Mining Company did some sluicing in this locality in 1911, and later, in 1914 and 1915, the Cansuran Placer Company began large-scale hydraulic operations with monitors, but the enterprise did not prove successful owing, it is said, to difficulties in handling the large boulders and trees which had to be removed in order to reach the pay dirt.

Several engineers have made tests and estimates of the value of the gravels and dirt in the Cansuran region, the most conservative being that made by an engineer from the division of mines, Bureau of Science, whose average figure was 21 centavos (about 10 cents United States currency) per cubic meter (a little more than 1 cubic yard). Nothing has been done on this property since 1916.

Liangá.—Very little information is available at this writing with reference to the placer deposits on Hinatuan River near Liangá, east coast of Mindanao. Mr. Kane, perhaps the most experienced dredge master in the Philippines, a New Zealander, for many years identified with the industry in the Paracale district, Luzon, has tested it and is now (July, 1922), operating a modern dredge on the ground. Owing to difficulties of navigation on the east coast the dredge was taken overland from Agusan River in sections.*

Binabay River, Mindoro.—From time to time prospectors go to Mindoro, particularly to the Binabay River district (northern part) and sluice the gravels of that stream, but they always meet

with difficulties, the chief of which are climate and health conditions. In 1916 flumes for bringing in water for sluicing were built, but no appreciable amount of gold has ever been reported.

Placer, Surigao.—Much has been written about this region, especially by Goodman and by Eddingfield, but the following summary by Pratt in 1914 gives the most important point in its history; its chief interest at present is historical, as very little of consequence is going on there.

Surigao Province has been a producer of gold for many years, but promises now to become more important in this respect through the operations of the recently organized Cansuran Placer Company. Attention has recently also been directed to Surigao's mineral resources by reason of the discovery by Mr. H. F. Cameron, engineer for the Department of Mindanao and Sulu, that a large area along the eastern coast of the province is covered with iron ore.

Gold mining in Surigao began in very remote times. The metal, detected first in the sands of the rivers and beaches, was traced almost at once to its original home in small quartz stringers and pockets in the andesite, which constitutes a large part of the land mass of the region. Although small, these quartz bodies appear to have been rich in gold at the surface, and at many places the ore has been taken out from open trenches and shallow holes over considerable distances.

One of the best known of the early prospectors in the Surigao gold region was a Frenchman referred to by the Filipinos as Don Maximillano. Apparently this man explored most of the known gold localities in Surigao early in the last century. He is said to have died at Surigao sixty-two years ago. It is stated that he worked first with the placer gold in the vicinity of the present holdings of the Cansuran Placer Company about 11 kilometers south of the town of Surigao. Later he prospected the gold-bearing quartz at Tinabingan, Placer, but ultimately he moved to the eastern margin of Lake Mainit, where he made his home and did most of his mining.

There is to-day little evidence of mining on the site of Don Maximillano's property at Mainit. Bricks are found in one locality at the edge of the foothills surrounding the lake, which the older residents believe to have been part of a furnace used by the Frenchman. Depressions which probably mark former shallow pits are found in the same neighborhood. A little gold is obtained by panning in an adjacent gully, and assays of a few pieces of ore encountered near one of the gold pits show fairly high gold values. There is no showing of ore in place, however, and it appears improbable that much mining was done here. The Frenchman is believed by the local people to have been rich, but he might easily have made enough from agriculture in this fertile region and from the sawmill, which he operated in clearing his land, to impress his simple neighbors.

A former mine which is famous in Surigao Province was located on a small island named Campiña, east of the Island of Masapelid in the jurisdiction of Placer. Gold was discovered on Campiña, the area of which is less than 1 hectare, about the year 1883, and mining was carried on assiduously for a period of two years, according to the president of the town of Placer. Mr. Maurice Goodman, a mining engineer, formerly in the Bureau of Science, visited Campiña and found rather extensive old workings, but although he took numerous samples, his assays showed only very low values in gold. It is probable that the miners followed the usual rich stringers in andesite and exhausted the small deposit. It is estimated by some of the old miners that Campiña yielded 30,000 pesos in gold.

Curuon, Mindanao.—Captain Leonard, a veteran of the Philippine military campaigns, has been working some placers by sluicing on the headwaters of Curuon River, about 75 kilometers northeast of Zamboanga, Mindanao, for some years on a small scale and with only moderate success. There is no question that gold is there, but it is not known that it exists in quantities sufficient to justify any large expenditure of capital. The gold is derived from auriferous schists in the backbone of the peninsula.

The following are the principal difficulties encountered in this branch of mining in the Philippines: "Spotty" nature of the ground, excessively large boulders and vegetation to be handled, not enough water at one time and too much at another, typhoons, and high cost of installing the proper machinery and of skilled superintendence.

(Continued on page 725.)

*The results of the first clean up of this dredge have just reached Manila from this out of the way corner of the Philippine Islands and they are rather gratifying, though they indicate nothing remarkable in the value of the ground.

The Need for Testing Materials of Construction used in the Far East

By C. A. MIDDLETON SMITH, M.Sc., M.I.Mech. E., (Taikoo Professor of Engineering in the University of Hongkong)*

DURING the rains of the summer of 1925 in Hongkong, there were two disasters, involving loss of life, caused by the collapse of retaining walls. The first one occurred in the neighbourhood of the Happy Valley, which is an Eastern part of the city of Victoria. There was one death. Many tons of earth and rocks slid down from the hillside on to the recreation ground some two or three hundred feet below. The second disaster was worse. The loss of life was much greater. A retaining wall in about the centre of the city, built some 28 years previously, suddenly gave way. It caused the collapse of several houses just below it, and as many as 75 people lost their lives as a result of the accident. There were also many injured. The loss of property was not negligible.

In each case, there was the usual enquiry by means of a Coroner's inquest. Both juries had the advantage of evidence of experts.

It may be as well to explain for the benefit of those who have never visited Hongkong that practically every building on the Colony is on a prepared site. The nature of the ground when the island commenced its commercial career in 1841, especially in and around the city of Victoria, was such that speaking generally, there were no sites levelled by Nature. Of granite formation, the island rises up at a steep slope from sea level to a central ridge, the highest point of which is more than 1,700-ft. above the sea. During the development of Hongkong, there have been many reclamation schemes. At present, the whole of Morrison Hill is being thrown into the sea, and the result will be many acres of level ground, some reclaimed from the sea. Where Morrison hill, a conspicuous land-mark in the Colony, stood formerly, there will be several acres of flat ground suitable for recreation purposes.

Buildings on the reclaimed land must have special foundations. As, in accordance with modern practice, and because of the high value of land in the city, many of the new buildings are eight or ten stories in height, great care must be taken to secure firm foundations. Modern systems of pile-driving are employed.

The Retaining Walls

It usually happens that any building erected on the hillside in Hongkong has a retaining wall, either in the front or behind it. Often, there is one in front and one behind. The ground is mostly

decomposed granite with solid granite boulders of varying size embedded in the soil. When building, these boulders are split up, and the granite is used for making the retaining walls. Also when broken up into small pieces and mixed with sand and cement it is used for concrete.

There will never be any lack of granite suitable for these purposes on the island, however extensive the building operations may become.

Since the introduction of the reinforced concrete method of construction for buildings, a great deal of steel, as well as cement, has been used in building work in the Colony.

There is very little evidence of reinforced concrete retaining walls in Hongkong, probably because the much thicker walls built of granite blocks are cheaper to build.

The retaining walls of the early days were made almost entirely of granite blocks. These were faced to be more or less rectangular and were of such a size that a man could lift one of them. They were placed one on top of the other and remained in position because of their weight and the thickness of the wall. It may be mentioned that, as the blocks did not fit absolutely close one along, side the other, there was usually a very good chance that any water which accumulated behind the wall, found an easy outlet through the small spaces between the blocks. In other words, the drainage of water was more or less provided for by the somewhat crude construction of the walls.

One drawback to that type of wall was that rats and other vermin found shelter between the stones. In the neighbourhood of dwelling houses, this was, after a time, considered a serious matter from a health point of view.

The discovery that rats were plague carriers and the knowledge that even small patches of stagnant water enable the malaria-carrying mosquito to breed made the Sanitary Department of the Colony view this type of wall with disfavour. There are, however, still to be seen examples of these old style retaining walls in the Colony, although, as far as the writer is aware, such walls are now never built.

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Ambulance corps rescuing survivors and recovering the dead



View of a site on which stood the houses, that were demolished and buried beneath the debris shown



View of the side wall and fallen matshed

The Building Authority

In Hongkong, the local Government assumes a more or less general responsibility for the life and property of the inhabitants. The biggest spending Department of the Government is the Public Works Department, usually referred to as the P.W.D. The Head of the Department is called the Director of Public Works. He is a member of the Legislative Council and is a civil engineer by profession. He has a large staff of European and Asiatics responsible to him. The P.W.D. in Hongkong always seems to have had severe critics. Its work is much more before the general public than let us say, the work of the Crown Solicitor or the Government Auditors. People always complain when roads are being repaired or the water supply fails. It not unfrequently happens that nontechnical men, with no knowledge of the difficulties of engineering work, and no appreciation of the skill needed to surmount them, are the loudest critics.

The Public Works Department is split up into sub-divisions dealing with watersupply, roads, harbour improvements, reclamations, buildings, surveys, electrical matters, etc. Two separate divisions deal with buildings. One, called the Architectural Department, is concerned with the erection and maintenance of buildings used by the local government, of which there are, of course, a large number. The Military and Naval Authorities have their own officers for this class of work and their buildings do not come under the notice of this Architectural Department which is concerned only with quarters, public buildings etc., belonging to the local Government.

The other division of P.W.D. which has to do with buildings is called "the Building Authority." There is local ordinance which gives the Building Authority definite powers. It will be shown later

that the general opinion in Hongkong is that this Building Ordinance requires bringing up-to-date.

The head of the division called the Building Authority is an Executive Engineer responsible to the Director of Public Works, who, in the end, is responsible to the local Government. The Executive Engineer, however, has very grave responsibilities to shoulder. Although he frequently reports to and consults with the Director of Public Works, it is obvious that the latter cannot possibly attend to the details of all the many divisions of his Department and also carry out his duties as a Legislator and general supervisor of his staff and initiator of new Engineering schemes for the improvement of the Colony.

Another Department of the Government, entirely separate from the Public Works Department, is also concerned with buildings in the Colony. That is called the Sanitary Department. All plans of new buildings are submitted by the Building Authority to the Sanitary Board for comments. Primarily, the Sanitary Board concerns itself with public health problems.

In the case of a citizen of the Colony wishing to build a new house, or planning to make any structural alteration of any description in any existing building, he must employ an authorised architect or civil engineer. The local Government publishes a list of these gentlemen. No one may practice as an architect or civil engineer in Hongkong unless his name is on the list. An advisory committee recommends names to the local Government.

The authorised architect makes plans and submits them for approval to the Building Authority. No work can be commenced until the latter has passed the plans.

The inevitable tendency of the Building Authority is to play for safety. This tendency is reflected in the offices of the architects who save themselves the probability of having to amend plans if they make everything very safe. The Building Authority insists on definite regulations about the thickness of walls etc. If, on the one hand, the architects complain that these regulations make the cost of building very high, the obvious reply of the Building Authority is that Chinese contractors are not reliable and local conditions, such as the abnormal wind pressures of typhoons and the heavy rainfalls, make comparison with details of buildings in England useless.

The fact remains that the cost of building in Hongkong is very high indeed. Some of this is due to the cost of the preparation of the site, which seems to average about 20 per cent. of the total cost of the building. Some of it is due to the cost of materials. And although Chinese labour is said to be cheap, the methods employed, and possibly the effect of the climate, leads one to wonder whether, in the end, the cost of the labour is really very much less than that of labour for similar work in England. It is difficult



A matshed which fell about 50-ft. It was on the top level before the collapse of the wall



Scene Soon after the Disaster, looking up from the Blake Gardens

to compare local costs of building with those in England, because the practice in Hongkong is to build higher rooms and to provide fairly wide verandahs. Yet it costs about £5,000 to build any house at all on the Peak. The writer recalls one ordinary two storied house of about seven rooms that cost £12,000.

One noticeable feature of the present system is an almost complete absence of any regulations concerning the strength of the materials used in building construction. The Building Authority has a very limited number of inspectors whose duty it is to visit buildings during construction to see that the plans are adhered to strictly and to report on any materials used. From time to time, the Building Authority has prosecuted contractors for using mortar of a poor quality, but of late, this practice seems to have fallen off. Either the contractors do not transgress—which seems unlikely—or, what is more probable, the Building Authority has been insufficiently staffed.

Materials Sent to China

During the last thirteen years, the writer has been lecturing to engineering students in the University of Hongkong. The equipment includes a fairly complete outfit for testing the materials of construction. There are definite routine experiments for testing cement, bricks, steel, timber, etc., and as far as possible, the materials used are varied.

The basis of comparison for these tests is that of the British Standards specification. That is because these standards are usually accepted as reliable and safe by all Anglo-Saxon engineers. Also any materials used in the local shipyards or other places where certificates are demanded are made to comply with these specifications.

It may be stated at once that very little of the local steel purchased casually does comply with the requirements of the British Standards Specification. It is the opinion of the writer that nearly all of the steel that has been used for reinforced concrete construction in this part of the world has failed to meet the requirement insisted upon in England. A great deal of this steel comes from the Continent of Europe, and some from Britain and America. A well-known local engineer, who had great experience of testing steel in Britain and America, discussed this matter with the writer. On seeing the results of many tests on steel made in the University this engineer said "of course they are just dumping steel that would not be used in ordinary practice at home. It is a case of "send it out to China, they won't

worry." It ought not to be allowed." As these sentiments exactly coincided with those of some of us who had thought the matter over carefully for some time, they are worth recording.

There are three tests to which samples of steel from every consignment used in reinforced concrete buildings should be subjected. They are (a) tensile tests (b) cold bending (c) bending after tempering.

The tensile tests should give the yield-point, the ultimate strength and the elongation. The yield-point is a most important figure as if once that is exceeded in actual practice the material is untrustworthy. There is, of course, in actual practice, always a factor of safety in the design of reinforced concrete buildings, but it must be always considered bad practice to use bad materials. It must be emphasised that the factor of safety is to allow for unexpected stresses, etc. It is not employed to cover up defects of material.

We may therefore say that any reinforced concrete structure in which the steel used is below the requirements of the British Standards Specification must be defective. On that basis, there must be a number of defective buildings in Hongkong.

It is not the intention to make a panic. No doubt the factor of safety will cover the defective material and the buildings, being liberally designed, will be stable for many years. What is insisted upon is that it is essential, for the protection of the public, that all steel used in reinforced concrete should be used only when there is a satisfactory certificate as to its physical properties.

The Question of Cement

Exactly the same statement applies to cement. There have been used in Hongkong cement of various brands. Some of the cement is made locally, some is imported from Formosa, Haiphong, Phillipine Islands, etc. The quality of this cement varies. It would be improper to give the names of the brands of cements which the writer considers most reliable. It is no guarantee that because in August 1925 a sample of the "Owana" brand gave a good result, the consignment delivered in October 1925 or 1926 is equally good. It is necessary to make tests on a sample from each consignment. That is done in Hongkong by a very limited number of architects or contractors.

It may be mentioned that, as Hongkong is in the tropics,



View showing part of Terrace of Houses, Three Houses similar to these shown were entirely Buried by Debris of Wall

and as the humidity of the atmosphere is very great, it is at least open to discussion as to whether the tests for cement as recommended by the British Standards Committee are really applicable. In that connection, the writer suggests that possibly the increase of strength required for the tensile tests made 28 days after mixing the briquettes, as compared with the results on tests made seven days after mixing, are perhaps not suitable. Any chemical action is affected by temperature. The general effect of making tests in an atmosphere of 88°F. instead of 64°F. would probably be for the chemical action to take place much more rapidly in the 88°F. temperature.

To express the idea in another way, we can almost assume that if the same cement is mixed in two different temperatures of 88°F. and 64°F., then the chemical action on the former that takes place in an interval of five days might be just about the same that takes place in the latter after seven days.

This is, of course, a problem that requires very full investigation before any definite opinion can be given. The subject is mentioned because it does seem unfair to reject a cement that fails, in the tropics, to conform exactly to the British Standards Specification for the increase of strength demanded for the tensile tests after 28 days. The opinion of the writer is that if a cement gives a fairly high figure for the 7 days tests and a definite increase for the 28 days test, then it is reliable. The cement that should be rejected is that which shows no increase at all.

It is important to insist that mortar tests be made. Tensile tests on neat cement are not so informative as tests on mortar. The difficulty about the mortar tests is the sand. Standard sand is not available in China, but if great care is taken in the selection and washing of the sand, the mortar tests should be reliable.

The Use of Lime Mortar

A quotation from the report of the technical experts who investigated the collapse of the retaining wall which caused the loss of 75 lives in Hongkong may be permitted. "In rebuilding important retaining walls Portland Cement would no doubt be used in place of the lime and red earth used in old designs."

It has been the practice in Hongkong to use mortar made up of local red earth (which is really decomposed granite), and lime. That practice has been carried out, not only in the building of retaining walls, but in other building operations. It is one that should cease. It is hoped that one result of this disaster will be the revision of regulations regarding the composition of mortar.

No doubt if Portland cement were used always the building regulations could be revised. The real difficulty is that of supervision. As soon as the Inspector's back is turned, the cement will be omitted by the contractor, in nine cases out of ten. Heavy fines or other penalties may be imposed, but the average contractor will run risks. It is impossible to have a reliable inspector standing over every building job in the Colony. The number of such inspectors employed by the P.W.D. should be very much increased, however, and possibly the police or sanitary inspectors might have power to report where cement is being wilfully omitted in the mixing of mortar.

The Problem of Drainage

The collapse of the Po Hing Fong wall took place on July 17th at about 9.30 a.m. In June there was a total rainfall of 23.3 inches and in July, up to the date of the disaster, there was a total of 18.8 inches. On the morning of the 17th there was 9.5-in. of rainfall between 1.30 a.m. and 9.30 a.m. The collapse happened just at the end of that very heavy rainfall.

So far as one can gather from the newspaper reports the experts and the coroner were agreed that the rainfall had nothing to do with the collapse. It is not the intention of the writer to dispute with the experts, but the ordinary person will think it a coincidence that the wall failed just after this very heavy rainfall.

This was an old wall and the experts were satisfied that there was ample drainage facilities for any water that might soak into the filling behind it.

The modern practice is to have weepholes in the walls. To be effective these must be kept clear. It is most important that the surface above the walls should be covered with cement rendering and wide channels provided for the escape of water. It may be that in the case of Po Hing Fong there was ample drainage, but

it is essential that precautions should be taken so that the minimum possible quantity of water should sink into the ground behind the wall.

The rough and ready method of design that is accepted by the local P.W.D. seems to be that the width of the wall at the base must be one-third the height.

In this particular case, there were three retaining walls forming the northern support of the site above the walls. Two of the walls were built in 1860 and one in 1897.

The Engineer in charge of the building operations on the site above the walls evidently had his doubts about the safety of the walls. Being a Government servant he reported the matter to the Director of Public Works who promptly visited the site. In returning their verdict, the jury expressed the opinion that "an error of judgment was made in deciding not to rebuild or strengthen the No. 1 retaining wall."

The writer has no wish to in any way defend the P.W.D. officials, but, as an engineer, he sympathises with them in the many difficulties which they encounter from a general public indefatigable in its criticism. One of the great causes of complaint is the expense of Public Works. It is always easy for any official to play for absolute safety by spending money. The faithful public servant is the man who, without undue risk for human life, tries to be economical. In this particular case, two of the walls had stood up for 65 years and the third had remained intact for nearly 30 years. It would have been a very costly business to rebuild the walls. It was, perhaps, totally abnormal conditions that caused the collapse. It is always easy to be wise after the event, but even if there was an error of judgment there was no negligence on the part of the Director of Public Works.

Reference has been made to the collapse of a wall near the Happy Valley in June. One death resulted and there might easily have been many more. The facts of this case seem to be much more clear than those of the July disaster. In June, the rainfall was also heavy and the root cause of the failure of the wall was the accumulation of water behind it.

An expert witness, Mr. Boothby, Chief Engineer of the Canton-Kowloon Railway, said that the cement mortar used was of "a very inferior quality; the aggregate appears to be soil found in the vicinity." The proportions were one in six. There were no records of any tests concerning the strength of the mortar, nor does that appear to be the common practice in the Colony.

In this case, the architect in charge of the work was very severely censured.

The Lessons of Tragedy

The old adage that "it is no use crying over spilt milk" still holds good, but it is very useful to have these public enquiries into the causes of any disaster that causes loss of life. There can be no doubt that the probability of any repetition is lessened. If it can be proved that human life is endangered because materials have not been tested, or supervision has been insufficient, we may be sure that the Government will insist upon reforms.

All engineering work is nowadays a matter of theories constantly tested by experiments. We make advances largely because of accumulated experience. There is very little sympathy for the Engineer who is negligent or careless. The consequences of such carelessness are usually much more appalling in Engineering than in other kinds of work. Thus, carelessness by an accountant may result in money losses. Carelessness by a doctor is not easily discovered and usually involves one life only. Carelessness on the part of an engineer may result in the loss of hundreds of lives and the carelessness cannot be covered up.

It is impossible to guarantee that any one of us is incapable of making an error of judgment. We can, however, make certain that the materials used in engineering work are reliable. That can only be done by insisting that certain definite tests are made on the materials used by engineers. We can play for safety in that way at least.

Additional Note re Retaining Wall at Po Hing Fong

Since the above was written, the question of the inspection of retaining walls has been brought before the Legislative Council of the Colony of Hongkong, and the Colonial Secretary, on behalf
(Continued on page 726.)



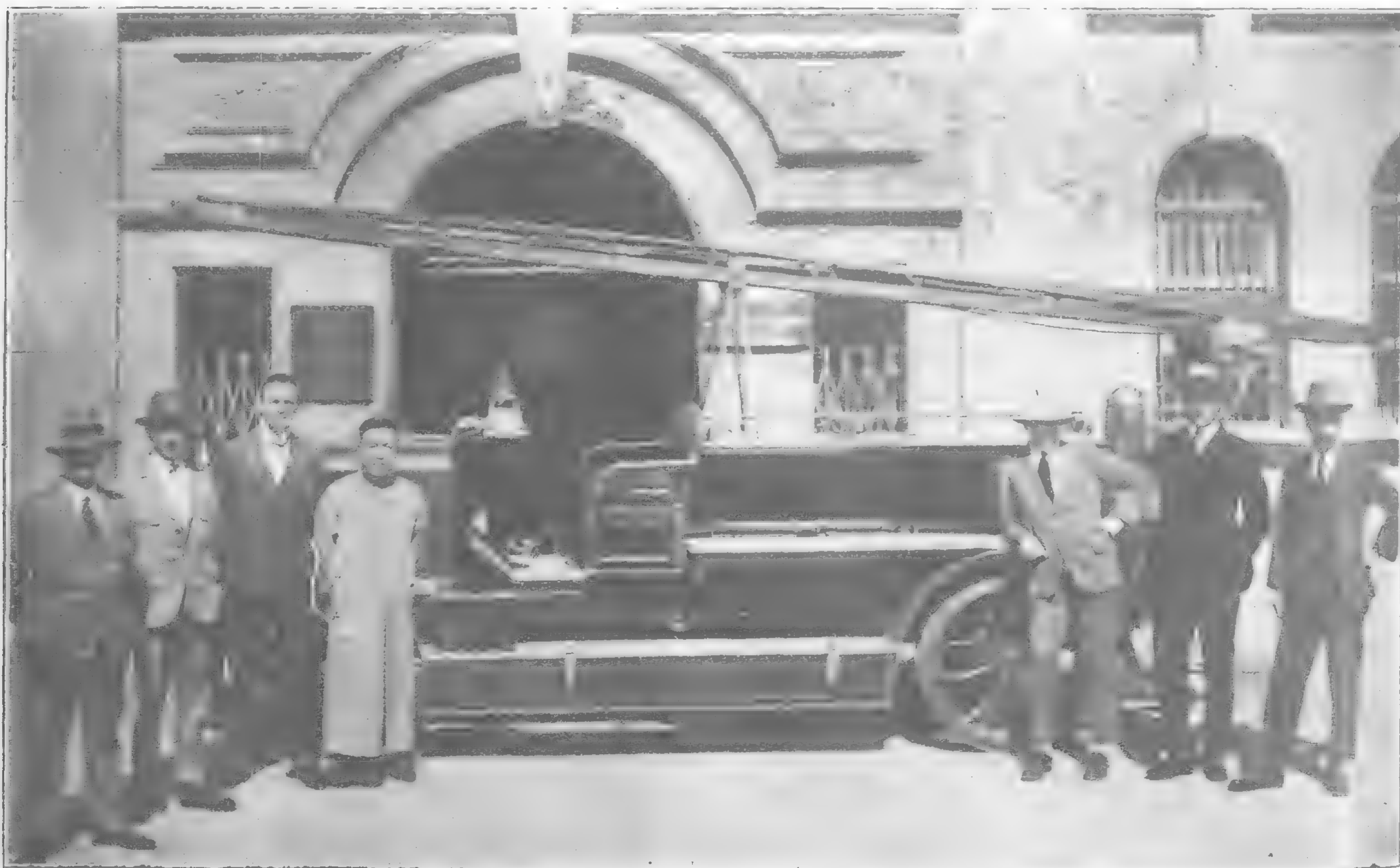
Tientsin Fire Brigade Testing its Pumps

Fire Fighting Machinery in China

THE various fire brigades in China, particularly in the Treaty Ports, are developing modern organizations and are using modern equipment. Shanghai's fire brigade is a particularly effective organization which has to face the most difficult problems of fire fighting because of the character of the city. The crowded areas of brick and wooden houses, the industrial factory and the crowded theater require constant attention in a city where law is not easily enforced because of the peculiarities arising out of the system of government under which foreigners and Chinese live in that city.

One of the latest fire fighting devices to be employed in Shanghai is the fire floats, a description of which follows:

The contract was placed with Messrs. Dixon Bros. & Hutchinson Ltd., who were responsible for the machinery and the design of the craft, the hull being built for them by Messrs. Day, Summers & Co., Ltd., Southampton. Owing to the awkward size and type of the vessel—too large for shipment complete and too small and unsuitable to make the voyage out on her own keel, it was necessary to send her out in plates and angles, with the machinery crated. The hull was built up (all the members being only bolted together



Merryweather's Motor Fire Engine "Hatheld," "D" Chassis-30 B.H.P., Swatow



Tientsin Fire Brigade, 1906

with temporary bolts) and taken down again after suitably painting and marking all the various plates and angles to agree with the working plans and wood model also supplied, to enable the native labour to re-erect it at Shanghai. The machinery was erected and coupled up to the pumps, etc., and tested in Messrs. Dixon Bros. & Hutchinson's shops and never entered the hull at all. This will have to be installed at Shanghai from the drawings and information supplied.

The boat has a straight stem and raised forward deck, with a good flare at the bows. The stern is a type of "slipper" or could be described as a modified "cruiser," having a very sharp turn in profile and very flat on the run. The machinery space occupies some 25-ft. A steel casing is arranged over the engine-room, the forward end being rounded and on top of which are mounted the distribution boxes. Forward of the engine casing is the steering cockpit, protected by the raised forward deck. Here is located the hand-steering gear of the Archer's selfholding pedestal type, whilst to port and starboard are paraffin tanks, with a combined capacity of some 200 gallons. Entrance is given to the forecastle beneath the raised deck, by a double door and sliding companion hatch on the starboard side. Two low teak skylights are fitted over the engine-room, on top of the engine casing, and opening circular lights in the casing sides. A stout towing hook is arranged amidships and tow rails and guards provided over the after-engine room skylight. Good bollards are fitted forward and samson posts aft in addition to two bollards. No mast is provided, so that the navigation head-light is carried on an iron stanchion. The rudder is of the balanced type, being a single steel plate carried in wrought-iron arms and coupled to a 2-in. diameter stock, on which is mounted a tiller arranged to take the wires from the steering gear.

A few excerpts from the specification as regards the hull may be of interest. Of Siemens Martin mild steel, the frames are of $1\frac{1}{4}$ -ins. by $1\frac{1}{4}$ -ins. by $\frac{3}{8}$ -in. angle, spaced 20-in. apart and in one length from keel to gunwale, heel pieces being fitted amidships. The floors are of $\frac{1}{8}$ -in. plate, fitted on every frame and extra deep in way of the machinery. Reverse bars are fitted across the tops, these being heavier in the engine-room than elsewhere. A centre keelson is fitted, formed of continuous double angles on top of the floors and an intercostal plate between the floors, lugged to the keel and floors. Similar-type side keelsons are fitted, one each side of the centre line. The side stringers are of single continuous angle, $1\frac{1}{2}$ -in.

Two watertight steel bulkheads enclose the engine-room, and are of $\frac{1}{8}$ -in. plate, stiffened by angles. The other bulkheads are of wood, whilst the coamings around the cockpit and after-hatch are of steel. The shell plating is $\frac{1}{8}$ -in. thick, the seams and butts being lapped. The

engine seating consists of a steel plate fitted on top of the floors, to take the holding-down bolts of the engines and pumps, which are mounted on a stout channel girder in one length, to avoid, so far as possible, errors in lining up. Teak pads are to be fitted between the girders and the plates on the floors. Twin engines drive the propellers through reverse gears and also each engine drives a fire pump through a Hele-Shaw clutch and chain. The two fire pumps are mounted on the centre line of the vessel, forward of the main engines. The engines are of Messrs. Dixon Bros. Hutchinson's standard type, operating on paraffin and petrol and starting on petrol. They are supplied right and left handed for

twin-screw installation. Each engine has six cylinders with a bore of 6-in. and stroke of $6\frac{1}{2}$ -in.; 105 b.h.p. is developed at 900 r.p.m. on petrol and 90 b.h.p. on paraffin at the same number of revolutions. The engines installed are being arranged to run to 1,000 r.p.m., at which 120 h.p. is obtained. Dual controls are provided to the engines, enabling them to be controlled either from the engine-room or from the steering cockpit. Forward of each main engine is the Hele-Shaw clutch and a length of shaft forward to the self-contained silent chain drive, mounted in welded steel casings with ball bearings. A plummer block is fitted immediately forward of the Hele-Shaw clutch. The after pump is driven by the port engine and the forward pump by the starboard engine. Both pumps are of the Rees Roturbo type. They are of the multi-stage design, each capable of handling 700 gallons per minute against a total head equal to 120-lb. per sq. in. or 1,000 gallons per minute against 80-lb. per sq. in. Provision is made for a fitting on deck, connected to the suction side of each pump, for salvage work. Special small self-contained pumps with clutches are fitted on the main engines to prime the main pumps. Each pump suction is provided with a 6-in. bore sluice valve, and a strainer box interposed between the seacock and each pump. The usual fuel filters are provided, together with an oil cooler each side of the engine-room. Petrol is carried in two tanks—one securely fitted at each side of the after-cockpit—with a capacity of 75 gallons each, so that sufficient petrol can be carried to operate the engines on this fuel for long periods when desired. An electric lighting set is located to port, supplied by Messrs. Dixon Bros. & Hutchinson. It has an output of $1\frac{1}{2}$ kilowatts, the dynamo being driven by a single-cylinder motor with a bore of $3\frac{1}{2}$ -in. and stroke of $3\frac{1}{2}$ -in. This set exhausts through a silencer and out at the vessel's side. It is anticipated that the speed will be 12 knots with both main engines in operation. The length is 57-ft. overall, whilst the extreme breadth is 12-ft. and the draught about 2-ft. 7-in.

In Tientsin, the fire brigades are still partly voluntary. The British Municipal Fire Brigade is under Police control, modified to some extent by an arrangement whereby local British Volunteers serve in the capacity of minor officers. The senior Police Inspector is Foreman. The strength of the Brigade is 29,



Part of the Present Tientsin Brigade

composed of six foreign officers and 23 Chinese firemen. Gear consists of one motor engine, one motor tender, one steam engine and about two miles of hose. The engines are of the latest pattern appliances, the motor capable of directing four streams at a nozzle pressure of about 250 pounds. Alarm can be given either by telephone or by pushing electric alarm buttons placed in many parts of the Concession.

The Fire Brigade, of the French Municipal Police is under Police control, with supervision by local French Volunteers. The strength is 34 Chinese firemen and engineers and two French officers. Equipment consists of four motor reel trucks, two Delahaye motor engines, one large escape, one electric and one steam pump and 6,000 yards of hose. Alarm is given by telephone and electric push buttons.

The Fire Brigade of the Italian Municipal Police is also under police control, without any special personnel. Equipment is one motor pump, capable of pumping 700 litres of water in one minute and a Fiat water cart, which can be immediately adapted to fire fighting, and 1,000 metres of hose. Alarm is raised by police whistles, sufficiently effective owing to the small size of the Concession.

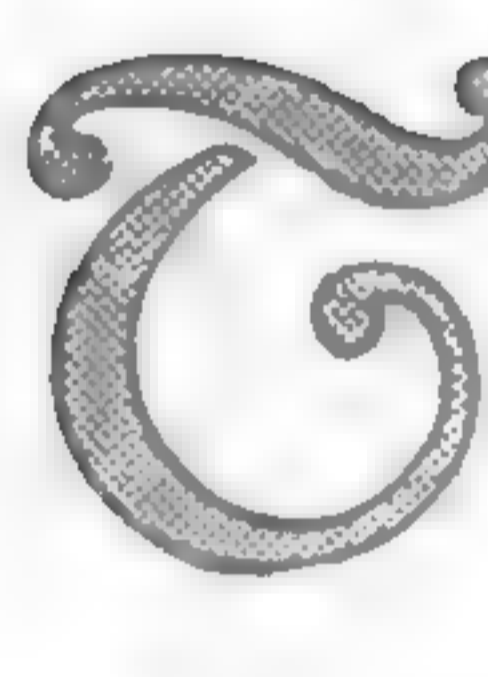
With regard to the motor fire engines in use by the British Municipal Council in Tientsin, the fire engine and motor pumps were made by Messrs. Dennis Motors Ltd. and the ladders by Morris Ajax.

The Swatow Police Fire Brigade recently improved its equipment by purchasing a Merryweather Motor Fire Engine, which is of the "Merryweather" latest type and is fitted with all the latest improvements, including a telescopic scaling ladder to extend to a height of 35 feet. The pump will deliver 250 gallons of water a minute up to a pressure of 115 lbs. per square inch.

An interesting incident occurred within 36 hours of its arrival in Swatow and whilst it was being assembled a fire broke in the northern part of the city and spread rapidly, involving ten or twelve houses. The authorities being unable to cope with the fire with their existing apparatus, the "Merryweather" Engine was rushed to the site, put to work through 800 feet of hose, and was able to extinguish the fire in a very short time, thus saving some thirty or forty houses from destruction. This incident is of special note as the engine had not been tested since leaving the makers' works.

The Ujikawa Electric Company

A Great Hydro Electric Enterprise in Japan

 THE Ujikawa Electric Company which was established on October 25, 1900 is capitalized at Yen 85,000,000 and produced an aggregate of 249,546 h.p. which supplies 314,925 lamps. The business of the company is in 8 prefectures, 5 large cities and 183 villages.

The Ujikawa Electric Company was formerly promoted to utilize the water of Lake Biwa, the largest lake in Japan, for generating power to be supplied to the cities of Kyoto and Osaka and their suburbs. Lake Biwa, which is widely known for its natural beauty, is situated in the centre of the Omi province and is 13½ miles wide and 40 miles long, covering an area of about 2,421 sq. miles. The waters of every river in Omi Province flow into this lake, which thus has a total volume of water of as much as 1,000,000,000,000 cubic ft. at ordinary times, its volume of water of the whole surface, being aggregating some 780,000,000 cubic ft. to one inch depth. Under such condition, even after a drought, little change is made in the volume of water. Moreover, upon completion of a dam by the Home Office in 1904 at Nango on the river Seta, the lake was practically treated as a reservoir, an ideal condition for a hydraulic power plant.

The company supplies hydraulic power which is generated by the power houses located at the River Uji as well as in the Yamato district. With the ideal "reservoir" of Lake Biwa, every power house of this company situated at the river Uji is capable of operating the year around, quite free from fear of shortage of the volume of water. As to the power houses located in the province of Yamato, in which is situated a dense forest district, providing that part of Japan with more rainfall than any other part. In addition, because of the topographical condition of Yamato, a "high head," one of the essentials for hydraulic power plant can be obtained there.

The business territory of this company covers Kyoto, Osaka, Kobe and their suburbs which comprise the industrial centers of Japan, having a large number of bulk consumers. As the distance between the power houses and these cities is very short, the cost for laying transmission lines is eventually small.

After its inception, the company erected a power house at Uji Machi in the Kyoto Prefecture, capable of generating 29,000 k.w.

and utilizing one part of water (2,000 cubic ft., per second) of Lake Biwa and to supply power to the two cities, Osaka and Kyoto. The construction work of this power house, which was sanctioned in December, 1907, commenced early in the following year and was completed by July, 1913, commencing operations on August 1 of the same year.

Excepting for electric light and tramways, power consumed for general industrial purposes was little in those days. Therefore, the company encouraged the use of electric power among the industrial circles, with the result that the demand for power so remarkably increased that with the power generated at a single power house, a shortage of supply was at once felt. To meet the increased demand the company, therefore, arranged to enlarge the generating capacity at the Uji Power House and had generators of a large type installed there to replace the old ones, thus increasing its generating capacity to 32,000 k.w. by August, 1922.

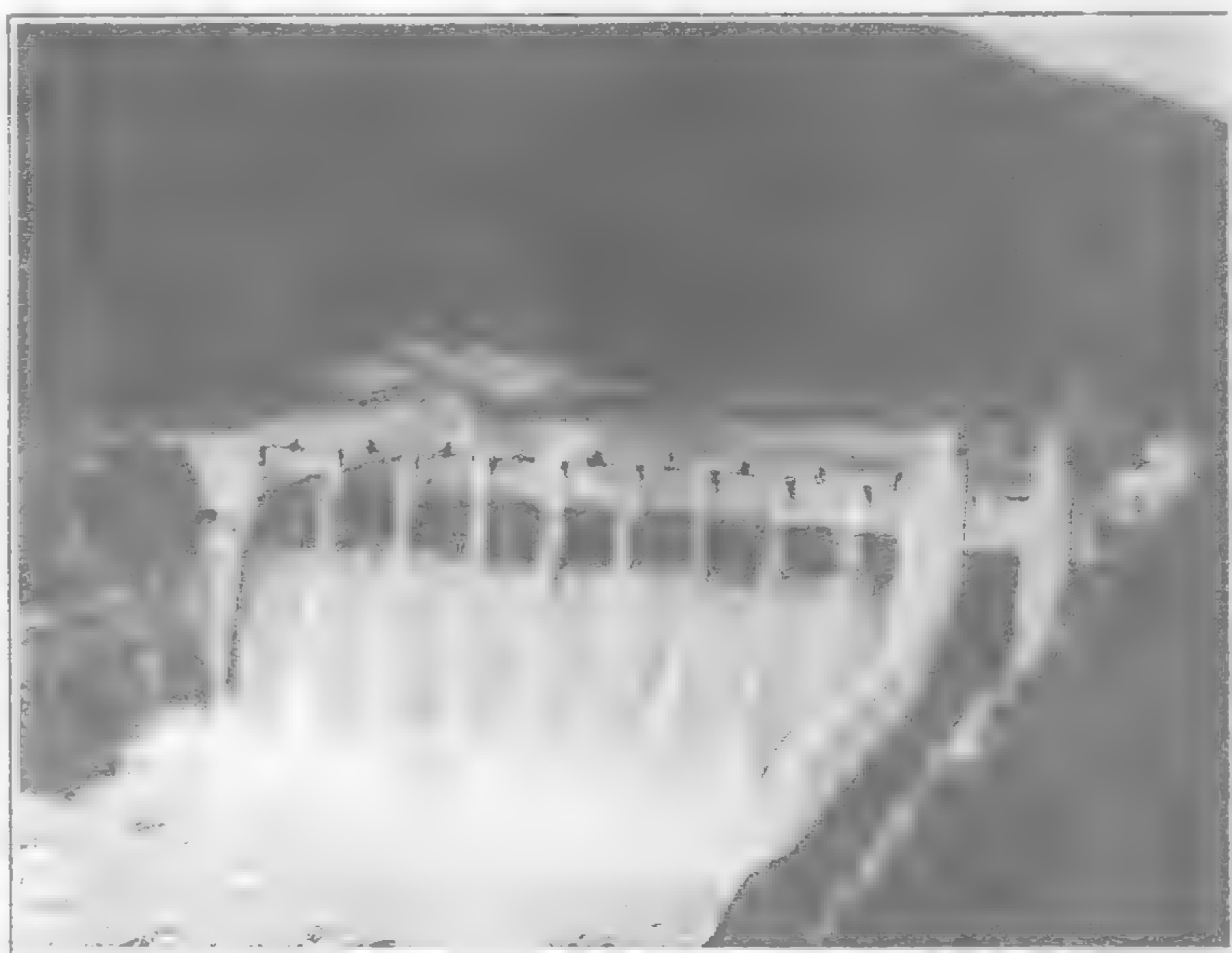
During the European War, industry in Japan increased and the demand for power likewise increased, with the result that a steam power station, the Fukuzaki Power House was built at the side of the River Shirinashi, near Osaka. The construction of this power house commenced in February 1918 and was completed in April, 1920. Its generating capacity was originally 30,000 k.w., which was later increased to 40,000 k.w. and the equipment for which was completed in April, 1923. In addition to this, the construction of Shidzukawa Power House located about 12 cho up stream of Uji Power House, with a capacity of 28,000 k.w. was commenced during September, 1920 and completed in March, 1924.

The Omine Power House which will be capable of generating 16,000 k.w. and is now under construction, is so located to be able to utilize a dam built at the intake of Shidzukawa Power House.

This company was originally established with a capital of Yen 12,500,000 but with the expansion of its business, the capital was doubled to Yen 25,000,000 in May, 1916. In September, 1921, after amalgamating with the Omi Hydro-electric Power Company, which had been supplying power and light to the whole north-eastern section along Lake Biwa, the capital was again increased to Yen 31,400,000, and in the following month, the Yamato Electric Company that had been supplying power and light to the extensive



Uji Power House



One of the principal dams

district in the Prefecture of Nara was merged with this company, with the result that the capital had to be increased to Yen 37,650,000. In May, 1922, this company amalgamated with Kumano Electric Company and consequently, the capital was again increased to Yen 38,700,000. Again by merging the Taisho Hydro-electric Company which aimed at supplying power to the whole city of Kobe, the capital came up to Yen 41,366,650 in October in the same year. Finally, in November, 1922, the capital was increased to the neighborhood of Yen 85,000,000.

The business territory of this company now covers 11 prefectures, 5 cities and 183 towns and villages including the three largest cities, Kyoto, Osaka and Kobe to all of which power is supplied by this company. Besides supplying power from its own generating plants, this company is now meeting with increasing demand of power from other electric power companies.

Equipment for the Generating Plants

The following table shows the total generating power with its equipment for generating power plants which include plants, now in operation, and under construction as well as not yet set to work :

	Now in Operation K.W.	Under Construction K.W.	Not Yet Set to Work K.W.	Total K.W.
By Hydro ...	71,697	31,570	23,957	127,224
By Steam ...	40,000	—	40,000	80,000
Total ...	111,697	31,570	63,957	207,224

Hydraulic Power Plant

Name of Power House	Name of River	Generating Power K.W.	Remarks
Uji	Ujikawa	32,000	Now in operation
Shidzukawa	"	28,000	"
Ohira	Ujikawa	5,400	Not Yet set to work
Omine	"	16,000	Under Construction
Tawaragawa	Tawaragawa (Kyoto)	460	Not yet set to work
Kiwada	Aichigawa (Shiga)	2,204	(1,469—in operation 735—not yet set to work
Kayao	"	640	In operation
Aidani	"	747	"
Anegawa	Anegawa (Shiga)	615	"
Ibuki	"	3,171	Not yet set to work
Koidzumi	"	450	"
Takatokigawa	Takatokigawa (Shiga)	1,039	Under construction
Tadehata	Kanzakigawa (Shiga)	2,052	Not set to work
Sako	Takaharagawa (Nara)	500	In operation
Kashio	Yoshinogawa (Nara)	2,365	"
Yoshino	"	1,661	"
Tenkawa	Horagawa (Nara)	640	"
Shirakawa	Shirakawa Mata Gawa (Nara)	2,414	"

Name of Power House	Name of River	Generating Power K.W.	Remarks
Suriko	Kitayamagawa (Nara)	5,610	Under construction
Nagatono	Amanokawa (Nara)	8,921	"
Zenki	Zenkigawa (Nara)	2,176	Not set to work
Totsugawa	Totsugawa (Nara)	8,315	"
Takataki	Onogawa (Nara)	442	"
Ikenogo	Ikenogogawa (Nara)	756	"
Takimoto	Takimotogawa (Wakayama)	240	In operation
Takata	Takatagawa (Wakayama)	136	"
Nachi	Nachigawa (Wakayama)	120	"
Osato	Ainoyagawa (Mie)	100	"
Funata	Yutanigawa (Mie)	50	"
Total		127,224 K.W.	

In addition to these, the Company filed an application for the water rights for 39,869 k.w. plants.

Steam Generating Power Plant

Name of Power House	Location	Generating Power K.W.	Remarks
Fukuzaki	Kitafukuzaki-Machi, Osaka	40,000	In operation
Kitsugawa	Funamachi, Osaka	40,000	Not yet set to work
Total		80,000	

Hydraulic Power Plants now in operation

The following are the principal power houses at the River Ujikawa.

UJIKAWA POWER HOUSE.—Location : Ujigo, Ujimachi, Kyoto-fu. Location of intake : Nango, Ishiyama-Mura Shiga-Ken. Length of Canal : 6,131 *ken* ; Column of Water Used : 2,200 *ken* ; Head : 205 *shaku* ; Generating Power : 32,000 kilowatt ; Turbine : six sets, 8,100 h.p. each ; Generator : six sets, 7,000 kilowatt ampere ; Transformer : 21 sets, 1,800 kilowatt ampere ; When Construction started : December, 1908 ; When Completed : July, 1913.

SHIDZUKAWA POWER HOUSE.—Location : Makioyama, Kyoto-fu (some 12 *cho* up-stream of Uji Power House) : Location of Intake : At the right side of the river Ujikawa (about 50 *cho* up-stream of the Nji Bridge.) ; Length of Power Canal : 1,0009 *ken* ; Dam, length 216 *shaku*, height 101 *shaku*, breadth of the top 28 *shaku* ; Length of water-filling section : 1 *ri* 26 *cho* ; Area of the above section : about 38 square *cho* ; Maximum depth : 86 *shaku* ; Volume of filling water : 129,000,000 cubic ft. ; Water tank : area, 530 *tsubo* depth, 24 *shaku* ; Water Pressure Pipe : six, each with 11 *shaku*, inner diameter and 102 *ken* length ; Head : 150 *shaku* ; Volume of Water Used : 2,800 ; Generating Power : 28,000 k.w. ; Turbine : six, each 17,000 h.p. ; Generator : six, each 14,000 kilowatt-ampere ; Transformer : 12, each 3,000 ; When started : September, 1920 ; When completed : March, 1924.

In the Omi District.

KIWADA POWER HOUSE.—Location: Kiwada, Higashi-Ogura-mura-Aichigun, Shiga-Ken; Location of Intake: At the above place; Length of Power Canal: about 2,000 *ken*; Volume of Water Used: 105; Head: 321 *shaku*; Generating Power: 2,204 kilowatt, 1,469 k.w. completed and 735 k.w. not set to work; Turbine: 2, 1, 100 h.p.; Generator: two, each 750 kilowatt-ampere, 1, 720 kilowatt ampere; When completed: April, 1922, the work was partially completed.

KAYAO POWER HOUSE.—Location: Kayao, Yamagamimura, Kanzakigun, Shiga-Ken; Location of Intake: Tadebata in the above district; Length of Power Canal: 1,575 *ken*; Volume of Water Used: 80; Effective Head: 137 *shaku*; Generating Power: 640 k.w.; Turbine: one set, 900 h.p.; Generators: one set, 800 kilowatt ampere.

AIDANI POWER HOUSE.—Location: Aidani, Yamagamimura, Kanzakigun, Shiga-Ken. Location of Intake: Same in the above district; Length of Power Canal: 290 *ken*; Volume of Water Used: 100; Effective Head: 116 *shaku*; Generating Power 747 kilowatt; Turbine: one set, 1250 h.p.; Generator: one set, 750 kilowatt-ampere.

ANEGAWA POWER HOUSE.—Location: Kami-Itanami, Higashi-Kusanomura, Shiga-Ken; Location of Intake: Magayaji in the above district; Length of Power Canal: 2,873 *ken*; Volume of Water Used: 35; Effective Head: 320 *shaku*; Generating Power: 615 kilowatt; Turbine: one set, 1,100 h.p.; Generator: one set, 720 kilowatt-ampere.

In the Yamato District.

SAKO POWER HOUSE.—Location: Sako, Kawakamimura, Yoshinogun, Nara-Ken; Location of Intake: Takahara in the above district; Length of Power Canal: 1,045 *ken*; Volume of Water Used: 13; Effective Head: 727; Generating Power: 500 k.w.; Turbine: two sets, each 600 h.p.; Generator: two sets, each 400 k.v.a.

KASHIO POWER HOUSE.—Location: Kashio, Nakashomura, Yoshinogun, Nara-Ken; Location of Intake: Otaki, Kawakami-Mura, Nara-Ken; Length of Power Canal: 1,580 *ken*; Volume of Water Used: 220; Effective Head: 176; Generating Power: 2,365 k.w.; Turbine: three sets, each 1,800 h.p.; Generator: three sets, each 1,250 k.v.a.

YOSHINO POWER HOUSE.—Location: Minmi-Narai, Nakashomura, Yoshino-Gun, Nara-Ken; Location of Intake: Kashio, in the above district; Length of Power Canal: 2,514 *ken*; Volume of Water Used: 350; Effective Head: 78 *shaku*; Generating Power: 1,661 k.w.; Turbine: three sets, each 1,100 h.p.; Generator: three sets, each, 1,000 k.v.a.

TENKAWA POWER HOUSE.—Location: Nakagoe, Tenkawa-Mura, Yoshino-Gun, Nara-Ken; Location of Intake: Horagawa in the above district; Length of Power Canal: 584 *ken*; Volume of Water Used: 18 *ken*; Effective Head: 548 *shaku*; Generating Power: 640 k.w.; Turbine: one set, 1,000 h.p.; Generator: one set, 800 k.v.a.; When completed: July, 1915.

SHIRAKAWA POWER HOUSE.—Location: Shirakawa, Kami-kitayama-Mura, Yoshino-Gun, Nara-Ken; Location of Intake: Kawai in the above district; Length of Power Canal: 2,206 *ken*; Volume of Water Used: 60; Effective Head: 602 *shaku*; Generating Power: 2,414 h.p.; Turbine, two sets, 2,200 h.p.; Generator: two sets, each 1,900 k.v.a.; When completed: June, 1921.

In the Kumano District.

TAKIMOTO POWER HOUSE.—Location: Takimoto, Oguchi-Mura, Higashi Mura-Gun, Wakayama-Ken; Location of Intake: In the same place, as above; Length of Power Canal: 1,455 *ken*; Volume of Water Used: 6 *ken*; Effective head: 687 *shaku*; Generating Power: 240 k.w.; Turbine: one set, 375 h.p.; Generator: one set, 300 k.v.a.; When completed: December, 1921.

TAKATA POWER HOUSE.—Location: Takata, Higashi-Muro-Gun, Wakayama-Ken; Location of Intake: In the same place as above; Length of Power Canal: 753 *ken*; Volume of Water Used: 4; Effective Head: 560 *shaku*; Generating Power: 136 k.w.; Turbine: one set, 200 h.p.; Generator: one set, 170 k.v.a.; When completed: September, 1919.

NACHI POWER HOUSE.—Location: Nachi-Mura, Higashi-muro-Gun, Wakayama-Ken; Location of Intake: In the same place as above; Length of Power Canal: 1,045 *ken*; Volume of Water Used: 105; Effective Head: 290 *shaku*; Generating power: 120 k.w.; Turbine: one set, 250 h.p.; Generator: one set, 150 k.v.a.; When completed: February, 1913.

In addition there are two more hydraulic power houses with aggregating capacity of 150 k.w.

Steam Generating Power now in operation

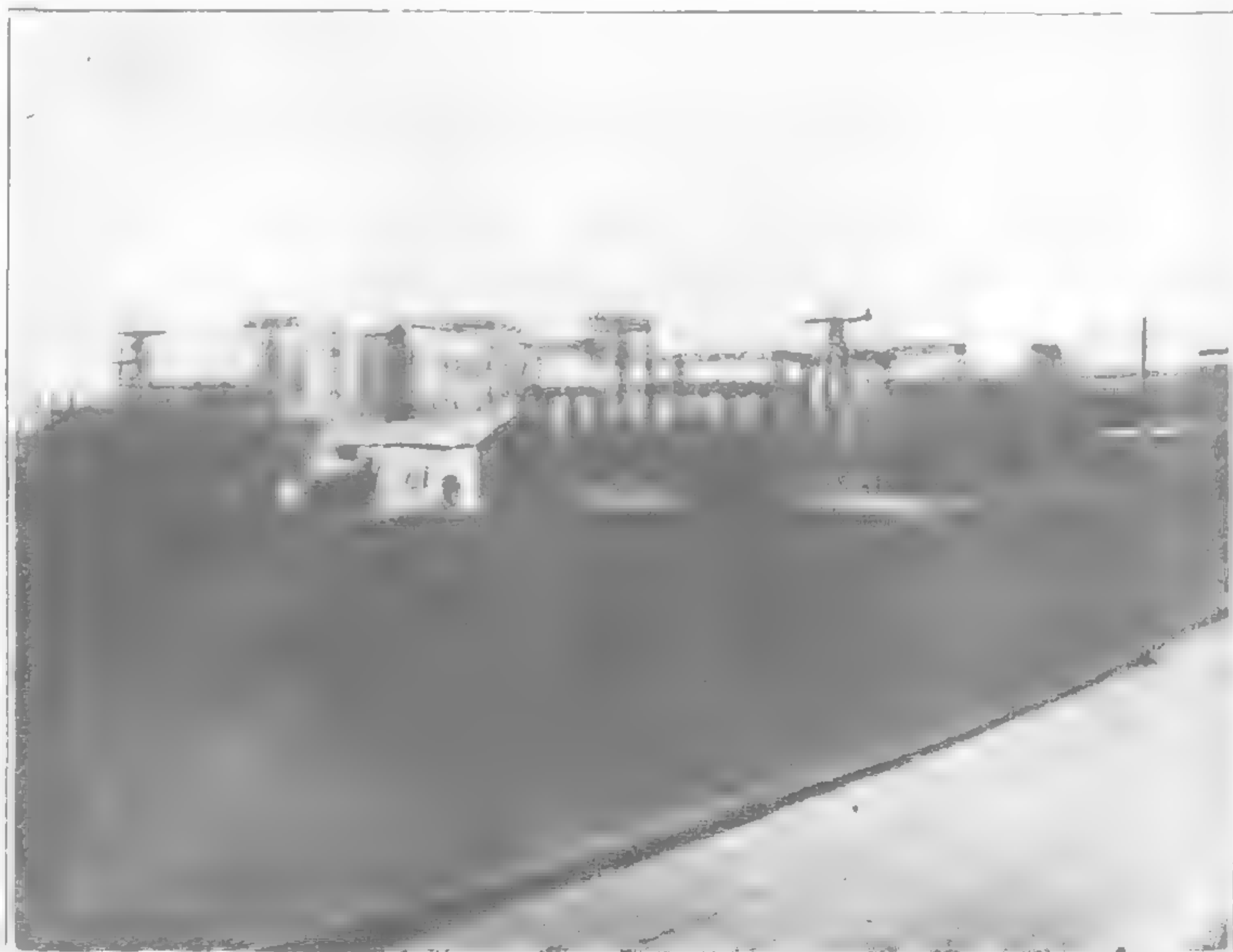
FUKUZAKI POWER HOUSE.—Location: On the right bank of the river Shirinashi, Fukuzaki-Machi, Minato-Ku, Osaka: The area of the ground: 7,350 *tsubo*; The building area: 865 *tsubo*; Structure of the power house: Two storeyed re-inforced concrete building; Boiler: 14 sets, each with heating area of 7,097 square ft.; Steam pressure: 250 pounds; Super heating degree: 225 degree Fahrenheit; Stokers: 13 sets of underfeed stoker and one set of coal-combustion appliance; Screening machine: 14 sets each with the area of 4,915 square ft.; Chimney: 5, all reinforced concrete; Steam Turbine: four sets each with 17,500 h.p.; Condenser: four sets each with 16,000 square ft.; Generator: four sets each with 12,500 k.v.a.; Coal-discharging equipment: 350 ton vessel can be moored at the right bank of the river Shirinashi; When completed: February, 1923.

Outline of the Extension Works.

Hydro-electric Power Plant (at the River Uji) (1) Ohira Power House, the construction work in the third stage (under application). Projected Location: Sotobatake, Ishiyama-Mura, Shiga-Ken; Projected Location of Intake: Nango, in the same district as above; Length of Power Canal: 2,200 *ken*; Volume of Water Used: 1,800; Effective Head: 48 *shaku*; Generating Power: 5,400 k.w.; Turbine: three sets each 4,000 h.p.; Generator: three sets, each 3,500 k.v.a.



Shidzuka Power House



Nagasone Sub-station

OMINE POWER HOUSE, (under construction).—Projected Location: Right under the dam of the construction work in the second stage; Projected Location of Intake: Up-streams of the dam; Length of Power Canal: 71 *ken*; Volume of Water Used: 3,500; Effective head: 70 *shaku*; Generating Power: 16,000 k.w.; Turbine: two sets each with 12,500 h.p.; Generator: two sets, each with 10,000 k.v.a.

Besides these, the Company has one more plant with a capacity of 460 k.w. on the course of the River Tawara. It was already sanctioned to start construction.

In the Omi District.

(1) IBUKI POWER HOUSE (sanction pending).—Location: Ibuki, Sakata-Gun, Shiga-Ken; Location of Intake: Magariya, Higashi-Kusano-Mura, Asai-Gun, Shiga-Ken; Length of Power Canal: 5,459 *ken*; Volume of water used: 90 *ken*; Effective Head: 527 *shaku*; Generating Power: 3,171 k.w.

(2) KOIDZUMI POWER HOUSE (sanction pending).—Location: Kubokaido, Sakata-Gun, Shiga-Ken; Location of Intake: Koidzumi in the above district; Length of Power Canal: 745 *ken*; Volume of Water Used: 76; Effective Head: 91 *shaku*; Generating Power: 450 k.w.

(3) TAKATOKIGAWA POWER HOUSE (under construction).—Location: Kawai, Takatoki-Mura, Ika-Gun, Shiga-Ken; Location of Intake: Omi in the same district as above; Length of Power Canal: 1,396 *ken*; Volume of Water Used: 200; Effective Head: 81 *shaku*; Generating Power: 1,039 k.w.

(4) TADEHATA POWER HOUSE (sanction pending).—Location: Tadehata, Kanzaki-Gun, Shiga-Ken; Location of Intake: Tobao in the same district; Length of Power Canal: 2,573 *ken*; Volume of Water Used: 60; Effective Head: 542 *shaku*; Generating Power: 2,052 k.w.

In addition to these, this concern has filed applications for two more plants with total capacity of 611 k.w.

In the Yamato District.

SURIKO POWER HOUSE (under construction).—Location: Kuwabara, Shimokita-Yama-Mura, Yoshino-Gun, Nara-Ken; Location of Intake: Ikehara, in the same district; Length of Power Canal: 1,650 *ken*; Volume of Water Used: 550; Effective Head: 187 *shaku*; Generating Power: 5,610 k.w.

NAGATONO POWER HOUSE (under construction).—Location: Nagatono, Totsugawa-Mura, Yoshino-Gun, Nara-Ken; Location of Intake: Wada and Shinohara of Yoshino-Gun, Nara-Ken; Length of Power Canal: 5,287 *ken*; Volume of Water Used: 235; Effective Head: 623 *shaku*; Generating Power: 8,921 k.w.

In addition to these, this company has 10 more projected plants with aggregated capacity of 35,225 k.w. The sanction for the construction is now pending.

The concern has filed an application for four more plants with total capacity of 1,719 kilowatt.

Steam Generating Power Plant.

Kitsugawa Steam Generating Power Plant (under application): Projected location: Funamachi, Minato-Ku, Osaka: Capacity: 40,000 kilowatt Generator: 25,000 k.v.a. (two sets).

The aggregated generating capacity of the plants of this concern including both those already in operation as well as those under construction amounts to 207,000 kilowatt of which 80,000 kilowatt is of the steam generating power.

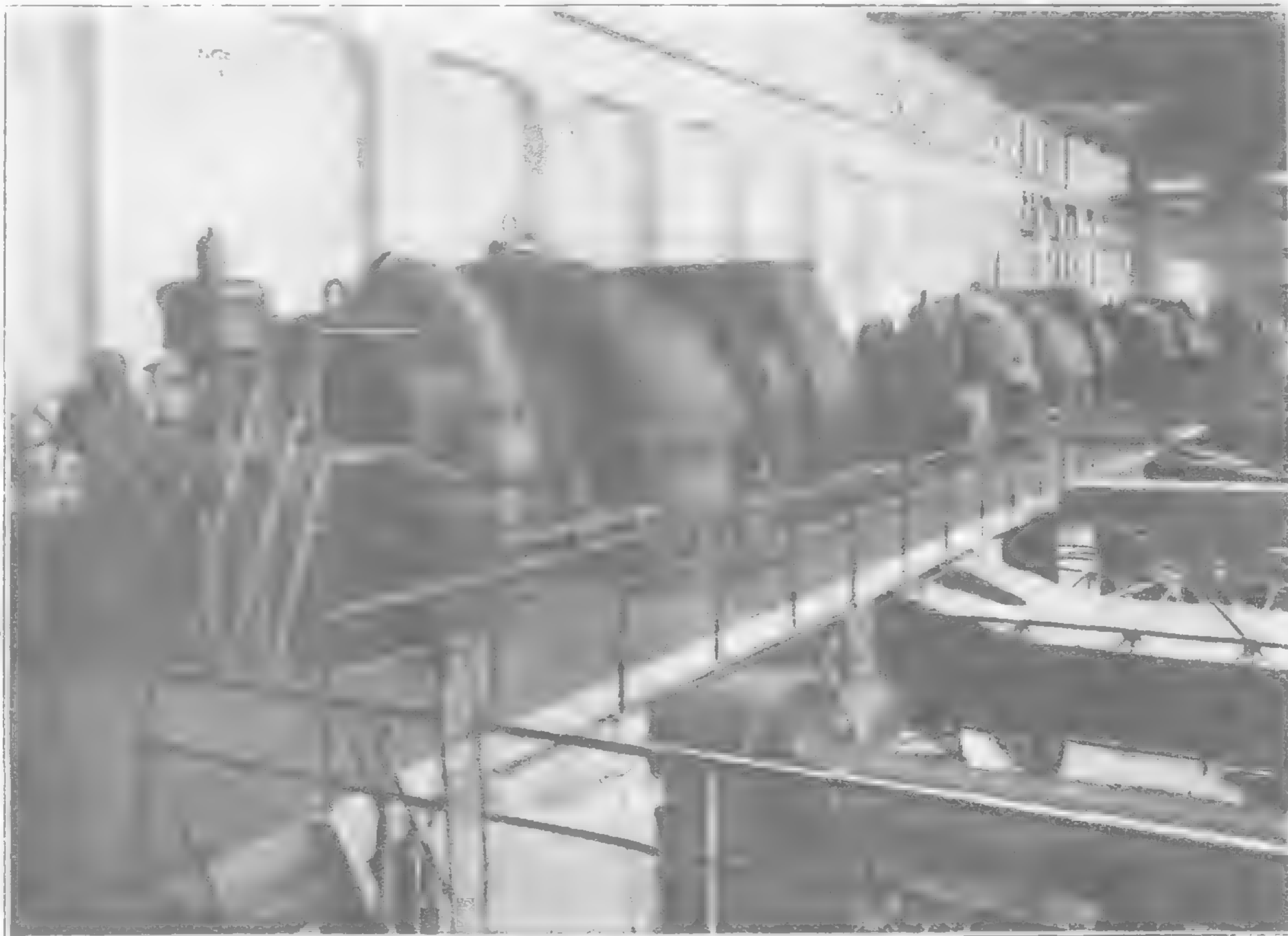
The quantity of power this company purchases from other concerns.

Though the total capacity is obtainable as much as over 200,000 kilowatt, it is not sufficient to meet with the increasing demands of power, light and heat in the Kansai District. To meet with the requirement, therefore, the company are now being supplied with

power from the following sources: Ibikawa Electric Company: 5,000 kilowatt; Nihon Electric Company: 40,000 kilowatt; Daido Electric Company: 17,600 kilowatt; Imadzu Electric Company: 10,000 kilowatt.

The equipments for transmission, supply and sub-station.

The Territory of Head Office: One part of the hydraulic power generated at the Uji Power House is to be supplied to Kyoto Electric Light Company through Kyoto transformer



Fukuzaki Power House Turbine Room

sub-station, some nine miles distant, by means of a transmission cable of 12,000 volt. and the remainder, after being transformed up to 55,000 volt. is supplied to Nae sub-station in the north-east of the city of Osaka through Neyagawa switching station. The length of the power cable between the section reaches to 21½ miles. At the Nae sub-station, the voltage of power is transformed down to 11,000 volt., this being supplied to the Osaka Electricity Bureau and every station of this company located in the eastern section of Osaka by means of the underground cable.

The power generated at Shidzuka power house is also transformed up to 55,000 volt and is transmitted to Neyagawa Switching Station by means of power cable having the length of 14.8 miles. Here, combined with the power from Uji power house, one part being transmitted to the Nae sub-station, while the remainder, through a power cable, 17½ miles in length goes to the Nagasone sub-station located in the eastern section of Sakai where the voltage is transformed down to 22,000 volt. Thus, the power is transmitted to every sub-station in the southern section of Sakai as well as Osaka.

Neyagawa Switching Station is connected with Kanazakigawa sub-station by means of 8½ miles power cable with 55,000 volt.

Kanzakigawa Sub-station would receive the supply of power with 55,000 voltage from Osaka sub-station of the Nihon Electric Company and after transforming the power down to 22,000 volt,

it is supplied to every sub-station in the western and northern section of Osaka.

The power supplied from the Daido Electric Power Company is received at Neyagawa Switching Station as well as at Abiko sub-station at Onomachi, Sumiyoshi-Ku, Osaka wherefrom the power is sent to every sub-station at Sakai and the Southern section of Osaka.

The power which is supplied from the Ibikawa Electric Company has the voltage of 77,000 which are received at Mikuni transformer sub-station located in the neighborhood of Kanzaki-gawa sub-station.

Power is transmitted from Shinjo sub-station which belongs to this company's Yamato Branch to Kobe sub-station by means of power cable 45 miles in length 77,000 voltage. After transforming down to 11,000 volt, the power is supplied to the Kobe Municipal Electricity Department.

The equipment above-mentioned are for the hydraulic power plant, and those for the steam generating power plants are one from Fukuzaki power house and other from Imadzu Electric Power Company. The power generated at the former power house is transmitted to every sub-station at the western and southern section of Osaka means of underground cable with 11,000 voltage. From the Imadzu Electric Power Company, power is received at Tachibana sub-station located in the North-western section of Amagasaki whence power is transmitted to its neighboring sub-station.

At the end of March, 1925, the total length of the lines for power supply was 2,524 miles of which some 39 miles were for the underground cable line, the remainder being the overhead line.

The Omi Branch: The voltage of power generated at the power house belonging to the Omi Branch is 3,500 volt, and increasing the voltage up to 20,000 volt, the power is transmitted to 10 sub-stations and one transformer-tower respectively. The connection among them is made by means of the transmission line with 20,000 volt.

The sub-station would generally supply power with 3,500 volt. reduced from the original voltage of 20,000. For the power of lamps, 50 or 100 volt. one is to be supplied, while for motors, 200 volt. power is supplied.

With the increasing demand of power in recent years, the present equipment for the power plant of the Branch seems to be incapable to meet with its requirement. At the outskirts of Hikonemachi, therefore, the Shohoji transformer sub-station was erected. One part of power with 77,000 voltage transmitted from Ibikawa Electric Company to Osaka is to be received here, and reducing it down to 20,000 volt, the power is supplied to various sub-stations.

One part of the sub-station located at Notogawa and Hachiman-machi is equipped to be capable to receive power totalling 600 kilowatt with the voltage of 14,000 from the Kyoto Electric Light Company.

The Yamato Branch: Of the Hydraulic Power plants belonging to Yamato Branch, the three power houses, Shirakawa, Sako and Tenkawa are capable to generate power 3,500 volt each. After transforming the voltage up to 16,500 or 44,000 volt, the power is transmitted to every sub-station within the territory of the branch. Again transforming the power down to 3,500 voltage, it is to be supplied for both purposes, light and power. For the former, power with 100 volt, is used and the latter, 200 voltage.

One part of power with 44,000 volt generated at Shirakawa power house is transmitted to Suriko sub-station some 8 miles distant. Here transforming down to 22,000 volt, the power is transmitted to the two sub-stations at Kimoto and Shingu in Kumamoto some 27 miles off.

At the two Power Houses, Yoshino and Kashio, power with 3,300 volt is generated, and the power, after being increased in the voltage as 33,000 volt. is transmitted to Shinjo sub-station about 15 miles distant where it is raised again to 77,000 volt and trans-

mitted to Kobe sub-station by means of transmission line, 45 miles in length.

Kumano District Office.

The voltage of power generated at every power house in this district is 3,500 volt. each and the power is directly supplied from each power house. The voltage of the transmission line which connects among Takimoto power house, Nachi power house, Katsura sub-station (now under construction) and Shingu sub-station is 11,000 volt.



Kashio Power House of the Yamato Branch

The both sub-stations, Kimoto and Shingu are to receive power from Yamato branch, and when supplying, the power is reduced from 22,000 to 3,500 volt. At Shingu sub-station, the power is raised in voltage up to 11,000 volt. and transmitted to the sections of Katsura-Machi.

Shingu sub-station has besides an equipment to receive 500 kilowatt steam generated power with the voltage of 3,500 from Shingu Electric Power Company.

The voltage of power supplied in the district of Kumano Branch is 100 for light purpose and 200 for motor.

The current supplied from Head Office, branch offices and district is all of 60 cycle.

The following shows the transmission and supply lines of this company (end of March, 1925). Territory of Head Office: Total length of overhead transmission line 952.8 miles; Total length of overhead supply-line, 2,484.7 miles; Total length of underground transmission line 217.8; Total length underground transmission line: 39.4 miles; Omi Branch: Total length of overhead transmission line: 273.4 miles; Total length of overhead supply-line: 3,760.4 miles; Yamato Branch: Total length of overhead transmission line: 468.9 miles; Total length of overhead supply-line: 1,596.7 miles; Kumano District Office: Total length of overhead transmission line: 212.8 miles; Total length of overhead supply-line: 490.3 miles.



Kobe Sub-station

The following table shows this Company's sub-stations now in operation. (March, 1925).

Head Office :

Name	Description	Capacity	Location
Noe	Receiving	31,800 k.v.a.	Noe-machi, Osaka
Kyoto	do.	5,000 kilowatt	Higashi-kujo, Kyoto
Tachibana	Receiving and S'pling	18,000 k.v.a.	Amagasaki, Hyogoken
Nagasone	Receiving	14,200 k.v.a.	Kanaokamura, Osaka
Kanzakigawa	do.	54,000 k.v.a.	Mikunimotomachi, Osaka
Kobe	Receiving and S'pling	51,000 k.v.a.	Nishinada, Hyogoken
Urae	do.	30,000 k.v.a.	Urae, Osaka

In addition, there are 20 more sub-station sagggregating 133,800 k.v.a. Besides with 12 switching stations.

Omi Branch :

Name	Description	Capacity	Location
Shohoji	Receiving	3,600 k.v.a.	Senbonmura, Shiga-ken
Hikone	Supplying	2,598 k.v.a.	Hikonemachi Shiga-ken
Nagahama	do.	1,500 k.v.a.	Rokushomura, Shiga-ken

In addition, there are eight more sub-stations including one transformer tower with total capacity of 4,950 k.v.a.

Yamato Branch :

Name	Description	Capacity	Location
Shinjo	Receiving	4,500 k.v.a.	Shinjo, Nara-ken
Gosho	Receiving and S'pling	5,700 k.v.a.	Goshomachi,, Nara-ken
Suriko (tem- porary)	Receiving	3,300 k.v.a.	Shimokitayama, Nara-ken

In addition, there are in this territory eight more sub-stations including one transformer-tower with total capacity of 1,915 k.v.a.

Kumono District Office :

Name	Description	Capacity	Location
Shingu	Receiving and Supplying	2,760 k.v.a.	Shingumachi Wakayama-ken
Kimoto	do.	360 k.v.a.	Arii, Mie-ken

The following shows the number of sub-stations now under construction; seven with aggregating capacity of 47,500 k.v.a. in the territory of Head Office; one with the capacity of 750 k.v.a. in the territory of Yamato Branch; two with total capacity of 900 k.v.a. in the territory of Kumano district office.

General Business Condition

The following table shows the yearly results since the operation of this company was started in August, 1913.

Head Office :

Year	Amount of H. P.	No. of Consumers
March 1914	40,276	1,476
" 1915	54,613	2,151
" 1916	63,859	3,011
" 1917	77,183	3,794

Year	Amount of H. P.	No. of Consumers
March 1918	87,160	4,784
" 1919	105,147	5,693
" 1920	111,389	5,879
" 1921	127,593	6,627
" 1922	144,851	8,318
" 1923	164,196	9,753
" 1924	200,550	10,993
" 1925	240,297	12,444

Omi Branch :

Year	No. of Lamps	No. of Consumers	No. of H.P.	No. of Consumers
May, 1921	141,313	84,498	2,073	571
March 1922	150,024	86,334	3,227	650
" 1923	168,141	89,396	3,888	988
" 1924	178,884	91,795	4,616	1,105
" 1925	186,249	92,857	5,798	1,415

Yamato Branch :

Year	No. of lamps	No. of Consumers	No. of H.P.	No. of Consumers
March 1922	51,020	24,419	2,474	243
" 1923	62,518	28,082	4,997	305
" 1924	78,865	31,999	9,995	366
" 1925	87,342	33,159	10,274	421

Kumano District Office :

Year	No. of Lamps	No. of Consumers	No. of H.P.	No. of Consumers
May, 1922	34,505	17,174	624	55
March 1923	36,699	17,582	865	70
" 1924	41,571	19,041	1,445	109
" 1925	43,453	19,896	1,605	148

Head Office :

The total amount of power which are directly sold within the territory of Head Office is 240,297 h.p. with 12,444 consumers. During the past six months, the amount of power has increased by 12,582 h.p. with 795 consumers.

Power for motor supplied-5,798 h.p. with 1,415 consumers.

During the past six months, the amount has increased by 293 h.p. with 196 consumers.

Yamato Branch

Number of lamps-97,342 with 33,157 houses.

During the past six months, it has increased by 4,727 with 354 houses.

Power for motor supplied-10,274 h.p. with 421 consumers.

During the past six months, it has increased by 72 h.p. with 30 consumers.

Kumano District Office

Number of lamps-43,453 with 19,896 houses.

During the past six months, it has increased by 1,369 with 348 houses.



Ananekawa Power House (belongs to Omi Branch)

Power for motor supplied—1,605 h.p. with 148 consumers.

During the past six months, it has increased by 138 h.p. with 27 consumers.

The following is the table showing where power, consumed number of motors installed and total h.p. (September 1924) :

Where Power Consumed	No. of Motors Installed	Total h.p.
Electrical Enterprise each has its own plant (7)		76,500
Iron Works	2,72	20,957
Cotton Spinning Mills	298	14,560
Saw-mills	517	9,215
Paper-mill	88	7,600
Copper-Works	59	5,903
Cement Factory	46	4,753
Cable Works	191	4,053
Dye Houses	371	3,955
Ice Manufactory	129	3,916
Water Works	17	3,172
Steel Mills	106	3,319
Shipbuilding yards	137	2,997
Rubber Manufactory	175	2,886
Glass Factory	483	2,649
Fertilizer Manufactory	118	2,618
Locomotive Makers	38	2,449
Public Works	176	2,121
Rice Mill	1,794	1,900
Pumping and Public bath house	339	1,846
Wire Manufactory	103	1,838
Foundry	282	1,810
Gilder	175	1,757
Celluloid Factory	134	1,688
Hemp-dressing	29	1,644
Wooden Works	411	1,550
Tannery	133	1,526

Far East Shipping Companies In A Bad Way

FROM OUR LONDON CORRESPONDENT

THE reports of two of the shipping companies trading with the Far East—the Java-China-Japan Line and the Indo-China Steam Navigation Company—which have just been issued, disclose a very unsatisfactory state of affairs.

The directors of the Java-China-Japan Line in their report of last years workings say that the civil war in China has brought great uncertainty both in commercial and political aspect, but that notwithstanding the many adverse factors the volume of trade expanded, although prices were unsatisfactory. Freights in the Far East could not be raised above the level of working expenses, trade with Japan being depressed by the financial difficulties in that country imports of the Netherlands East Indies improved, but the volume of return cargo is still small compared with the exports of sugar from Java to China and Japan.

The relation between the prices of bunker coal and oil has altered so materially in favor of coal that the use of oil by the company's steamers has had to be reduced, although the same possesses technical advantages and oil can be secured by the ships at Balikpapan in close vicinity to the wells.

The Java-Pacific line has not yet been resumed. The steamer *Tjibesir* has been commissioned, and the steamer *Tjiseroe* has been launched and will probably be ready in October of the current year. The agreement arrived at with the builders for the completion of this vessel meant a financial sacrifice to the company, which has been written down from the miscellaneous reserve. Gross profits on trading amount to 1,031,107 gls. which, being insufficient to cover expenses and depreciation has been augmented by adding

164,910 gls. from miscellaneous reserve and 807,653 gls. from depreciation reserve, the latter transaction having become necessary on account of the attitude of the East India authorities in respect of fixing the book value of tonnage in the preceding year, when this value had to be increased and the difference transferred to a depreciation reserve, which will be booked off gradually.

The Indo-China Steam Navigation Company has been hit very heavily by the shipping depression. So unsatisfactory, indeed, has been the result of the year's working that no dividend is to be paid either on the Deferred Ordinary or the 6 per cent. Preferred Ordinary shares of the company. The latter received its dividend for 1923, when, after transfers from contingency and investment fluctuation accounts, a credit balance was established of £16,000. For 1924 the credit balance on revenue account was only £945. The loss on the working of the ships was £104,400, and with the allowances of £105,400 for depreciation and general charges the adverse balance is raised to over £221,000. To meet this the contingency and investment reserves are drawn upon to the extent of £208,700, and with the addition of interest receipts and the small credit balance brought in the deficit is extinguished and the small sum referred to is established as a credit. There are, of course, special reasons for the poor results reported. Not only was trade depressed and the freight market unfavorable, but the company had to face the added difficulties arising from the trouble in China. No better outcome of the past year's operations could have been expected.

Passing of the "China"

WITH only a feet of scrap iron showing above the water, there is now passing out of existence, by the way of the ship-breaker, the old s.s. *China*, a vessel that for close on 36 years was one of the most popular on the Pacific. Over in Kowloon Bay the work of breaking up is being carried out, and the romantic career of a famous ship is fast closing. Built as long ago as 1889 by Messrs. Fairfield & Co., Ltd., of Glasgow, the *China* was one of the great liners of her day. Of over 5,000 tons gross registry, the vessel had three decks and a promenade deck, was 440-ft. in length, 48.1-ft. wide and 32.8-ft. deep. Her appointments and fittings were the latest then known in marine furnishings and she was turned out from the Clyde yard for the Pacific Mail Steamship Company with much pride. An interesting circumstance in connection with her early days was that, although owned by an American firm with head offices in New York, the vessel was placed under the Hawaiian flag. At that particular time, the laws of the United States were that no foreign-built ship could be placed under American registry without the payment of heavy fees, and so the owners of the *China* registered her at Hawaii, which was then independent but which was agitating to be taken over by America. When the islands were later taken over by the United States' Government, the vessel automatically became one of American registry and thus was saved the payment of the heavy fees which would have been necessary a few years earlier. The Pacific Mail Steamship Company operated the vessel, together with others, for some years and it was during those early days that the *China* enjoyed such popularity. The vessel was later sold to the China Mail Steamship Company, which had also bought the *Nile*, and was regularly on the Pacific run until the liquidation of the owners, some two years ago. Owing to bad times generally, the China Mail Steamship Company was unable to meet its obligations and the *China* was forcibly detained in harbour at Hongkong under an order made by the Supreme Court on the application of a number of creditors. The *Nile* was detained in San Francisco. At one time it seemed likely that the *China* would be acquired by a Chinese syndicate, but it was found that to refit the ship and to instal the new boilers which would be required would be too expensive an undertaking. Thus it has come about that the vessel lay in Kowloon Bay for many months, awaiting the settling up of the affairs of the owning Company. A short while ago she was sold to Chinese for breaking up, the *Nile* meanwhile having been disposed of in San Francisco for a similar purpose.

Round the World for Twopence per Mile

Description of A Wonder Ship—Cunarder "Carinthia"

FROM OUR LONDON CORRESPONDENT

THE last of the fourteen new vessels to join the fleet of the Cunard Line, the *Carinthia*, built by Vickers, Ltd., is a master piece of the shipbuilders' and decorators' combined arts. She sailed at the end of August on her maiden voyage. Nearly six months will elapse before she returns, and by then it is contemplated that she will have covered 30,000 miles, visiting Australia, New Zealand, America, and many other parts of the world. Incidentally, a mathematical calculation by a member of the Cunard staff shows, that the cost of such an experience works out at approximately 2d. per mile, or £2 per day.

Built at the Barrow Yard of Messrs. Vickers, Ltd., as a sister ship to the *Franconia*, the *Carinthia* is also specially designed for world cruises.

The *Carinthia* is the third liner of the company's present fleet to be built by Messrs. Vickers, Ltd., and the second liner of that name to figure in the Cunard fleet. All the latest developments are embodied in the *Carinthia*. Her passenger accommodation extends over seven decks, and all the first class public rooms excepting the restaurant, are on "A" deck.

She is designed to burn oil fuel and her dimensions are as follows:—

Length 624-ft., breadth 74-ft., depth 45-ft., tonnage 20,000. Accommodation for passengers, first class 331, second class 473, third class 810.

Though the general arrangements of the magnificent accommodation have been constructed on the same lines as the *Franconia*, there are many outstanding features as far as the decorations and furnishing of the *Carinthia* are concerned. Perhaps the most notable is that of the introduction of the Spanish school of art, which is to be found in the smoking room.

While much has been done in domestic architecture, it has been left to the Cunard Company to introduce Spanish forms of decoration in their entirety into an ocean going liner.

The scheme adopted in the *Carinthia's* smoking room is based on certain elements in the house of the great Spanish painter El Greco, who lived at Toledo in the fifteenth century. It is particularly appropriate that one of the great attractions of this apartment is an actual copy of El Greco's fine portrait of King Ferdinand, who, it will be recalled established the present Spanish dynasty.

Other masterpieces of the Spanish school of painting are represented by copies of the famous *jeune mendiante* by Murillo, Velasquez's Philip IV, Ribera's satirical study of a philosopher, together with several pieces of fine Spanish embroideries.

The windows surrounding the lower portion of the room have been very carefully studied. A typical Spanish lead light design has been employed, but a number of pieces of stained glass have been acquired and embodied in the work. The room itself is of two heights, and the arrangement has allowed the maximum space for the great central portion.

It is considerably greater than that of any other vessel of its class, and the advantage is sustained by employing four great stone mullioned oriels. The fireplace recess is formed by a typical arch, 12-ft. high over an intrados of intaglio tiles. The side walls of the central portion are treated with great wrought iron grilles, and between the grille windows hang long embroidered banners.

At the after end the shape of the room has been ingeniously screened off by small recesses on each side of a semi-circular bay window. The ceiling is typical of the period, and comprises an elaborate system of framed beams with geometrical patterns entirely in wood. The floor is of a type that has never been employed outside Spanish palaces. Instead of being ceramic, ruboleum has

been introduced. A number of modern Spanish etchings adorn the walls.

The lounge is in striking contrast to the smoking room. It is typically English, the decoration and furnishing representing the delightful period when William of Orange produced a composite style of British and Dutch forms. Walnut furniture, cross banded veneer and marquetry, old red lacquer black and gold furniture, rich velvet and tapestries present a pleasing 17th century atmosphere.

The Adam Restaurant.—The early manner of the Brothers Adam has often been greatly admired on account of its simplicity; even more so than their later decorative style which was largely influenced by the Louis Seize period and the works of Cipriani and Pergolesi.

The charm of the *Carinthia's* restaurant strikes a new note, the object of the designers having been to introduce as simple an effect as possible within the limited dimensions. The ideal expresses itself in the ventral portion which runs through the two decks. It is illuminated by two finely carved and gilded Adams torchers, throwing indirect lighting to the ceiling. The forward end of this central portion is of apsidal form, decorated with a reproduction of Le Brun's cartoon for the gobelin tapestry of the Chateau de Chambord. The original cartoon is in the Louvre.

The aspect is coffered and the tone of the painting is the key of the color scheme of the whole apartment. This has been carried out in French grey, with slight pink blush, and tones with the Norwegian rose marble columns and the rose and écreu marble ruboleum floor. At the after end there is a semi-elliptical treble arrangement of round-headed arches, giving skill and dignity to the treatment.

To avoid the danger of bareness and lack of interest of which this style is sometimes accused, the three arches have bronzed glazed screens. This arrangement forms a spacious foyer at the foot of the main staircase, where comfortable settees have been introduced. The delicate silver lamp standards on the small dining tables have shades of vellum painted with silhouettes and classical subjects.

The sports arena occupies some 5,000 square feet and extends through two decks. Spaciousness is its keynote, with a handsome teak staircase leading to a balcony overlooking the swimming bath. At each side of the bath and with separate entrances are the rackets court and gymnasium. Facing the balcony is a fine bronze copy of the Discobolus. The lighting system of the swimming bath is entirely indirect. It is based on triumphal columns similar to those erected by the Romans when bronze ship's prows were applied, and these prows have been made suitable for the form of lighting which has been introduced. There are, of course, the usual dressing cubicles, shower baths and electric baths for massage treatment.

The card room has been specially studied for the convenience of players, and the color scheme is a restful green consistent with the Cippolino marble columns. Over the fireplace has been placed a copy of a composition by Hubert Roberts, while at the forward end another composition by the same artist is flanked by four Hogarth engravings from the set "Marriage à la mode." There is also a fine display of Spode ware.

The drawing room closely resembles the decoration of the card room, the whole color scheme being blue and gold. There are comfortable settees and chairs for reading and convenient writing accommodation. The cabinets in this room display Wedgwood ware.

Eighteenth century treillage treatment has been adopted in the design of the two garden lounges. An improved type of window

gives these lounges the effect of a large verandah overlooking the sea. The decks have been specially treated for dancing.

The numerous staterooms have been fitted with beautiful mahogany bedsteads, large wardrobes, dressing tables, night tables, book cases, easy chairs and settees. There are also a number of suites comprising sitting room, bedroom and bath room, in addition to a large number of cabins de luxe.

Equal attention has been paid to the comfort of the second class passengers. They have the use of dining saloon, smoking room, lounge and verandah cafe.

The dining saloon has been executed in a vigorous Georgian style adapted to modern tastes so far as the color schemes are concerned. The marble columns of sang de boeuf strike a strong note of color against the vellum background. A very fine Georgian design of curtain gives a color note to the moulding and other painted details. A single torchere in the centre of the room lights up the whole central portion, while at each table are similar lamps to those in the Adam restaurant. A musician's gallery has been ingeniously introduced into the dome of the room.

The second class lounge can be described as a dainty Adam room. The rather severe walls have been relieved by mezzotints of the period and form a background to the graceful eighteenth century mahogany furniture.

The verandah cafe, with its leaded light windows and array of wicker furniture, overlooks the stern of the vessel and provides an uninterrupted view of the ocean highway.

The atmosphere of an old English Inn, with its oak panelled ceilings and walls, has been introduced into the smoking room.

An unusual amount of space has been devoted to third class accommodation. There are two large dining saloons which, with the other public rooms, have been decorated with simple oak panelling and white friezes. The walls of these rooms are adorned with a number of interesting pictures. The commodious cabins are fitted with berths for two, four, or six persons. There is also a library and ample space for promenading, games, and recreation.

The propelling machinery is fitted in one engine room, and consists of two sets of steam turbines of the latest Parsons' marine type, and driving twin screws through double reduction helical gearing. The complete turbine installation is capable of developing a collective shaft horse power of 12,500, with revolutions of propeller shafts about 90 per minute.

The total power of astern work is about 70 per cent. of the ahead power. Each set of turbines consists of one high pressure turbine driving through a flexible coupling one pinion, and a low pressure turbine driving through a flexible coupling the other pinion of the first reduction gearing, and through the second reduction pinions to the gear wheel mounted on the main shaft.

Astern turbines are incorporated in the casings of the low pressure ahead turbines. Adjusting blocks of the Michell type are fitted to the turbines and the bearings of the turbines and gearing are arranged to work under forced lubrication.

One condenser of the underhung type is fitted for each set of turbines, and bolted direct to the exhaust branch of the low pressure turbine. The main shafting is of ingot steel, and is finished bright all over. Each line has a main thrust block of the Michell type fitted next to the gearing to take up the propeller thrust. The propellers are of the built type with four manganese bronze blades to each, bosses are of cast steel, and cast iron cones are fitted over propeller nuts.

The steam generating installation consists of three double-ended and three single-ended boilers arranged in one boiler room, and suitable for a working pressure of 220 lbs. per square inch. The boilers are of the multitubular return tube type, working under forced draught.

The mean diameter of all the boilers is 17-ft. 6-in. and the mean length of the double ended boilers is 22-ft. 6-in., and of the single ended boilers 11-ft. 6-in.

Each double ended boiler has eight furnaces with eight separate combustion chambers, the single ended boilers have four furnaces with four separate combustion chambers. The combined heating surface for all boilers is about 29,160 square feet.

The boilers are arranged to burn oil on the Wallsend-Howden pressure system. The installation is arranged on the duplex system and consists of four complete sets of pumping and heating plant, two large and two small, two of the set acting as standby.

For the forced draught system, there are two pairs of Howden's single inlet fans electrically driven, one motor arranged to

drive two fans. All boilers are connected to a single large oval funnel.

The machinery and boilers have been constructed to the requirements of the Board of Trade, Lloyd's, and American survey.

A very full equipment of auxiliary machinery is fitted, comprising two circular pumps of the turbo-driven centrifugal type, one turbo-driven and two direct-acting feed pumps, extractor pumps, air ejectors, and other fittings in connection with Weir's closed feed system, and also the necessary outfit of forced lubrication, sanitary, fresh water, and other service pumps together with complete evaporating and distilling plant and auxiliary condenser and pumps.

The electrical installation produces another fine example of the very modern improvements which have been effected throughout in the construction of the vessel.

All the more important purposes to which electricity has been put on board ship are found, such as elevators for passengers, hoists for boats, baggage, stores, motors driving refrigerating and ice-making machinery, boiler-room fans, ship's and engine-room ventilating fans, galley and pastry machinery.

Electricity is further utilized for internal communications, such as telephones and bells; for navigational purposes, such as sounding machines and submarine signalling apparatus; for communication with the outer world by wireless telegraphy.

The *Carinthia* is equipped with two steam turbo-driven geared generators, each of 375 kilowatts capacity.

Developments in previous units of the Cunard fleet, and now in the *Carinthia*, have been in the direction of extending the use of electric power to the operations of the deck machinery, the capstans, windlass, cargo winches and steering gear being all electrically operated. Further use of electric power has been found in the laundry, in the prevention of corrosion in boilers, and in the rejuvenation of the human frame by electric sun baths.

The life saving appliances have had all the attention bestowed upon them that this important subject demands. The number of lifeboats supplied is more than sufficient to carry every individual aboard and are worked by means of Wellin's patent quadrant davits, thus insuring quick handling of the boats. The ship is also fitted with an installation of wireless telegraphy and two motor lifeboats.

Above the bulkhead deck the ship is divided by fire-screen bulkheads as a precaution against fire. In the event of fire in any portion of the ship the outbreak can be localized by closing the fireproof doors and then dealt with by means of the efficient supply of fire hydrants, hose, and chemical fire extinguishers installed.

The ventilation of the ship throughout is maintained by natural means supplemented where necessary, in the passenger accommodation by a mechanical installation. For this the directional valve system is employed, whereby a supply of fresh air, heated if desired, is supplied to any compartment or cabin, with means of regulating it at will, by the passengers. In addition, passages, cabins, corridors, and public rooms are fitted with radiators and small electric pedestal fans.

The compasses employed on the *Carinthia*, following what has become a custom in the Cunard line, are of the Sperry Gyro type, while Messrs. Kelvin, Bottomley and Baird have supplied the pneumatic tank gauges in use on board.

The kitchens, pantries, and bakeries of the *Carinthia*, are the most up-to-date in any vessel of equal size. No pains have been spared to make the plant the most efficient possible. The kitchens are large and well ventilated, and the flues from the ranges are carried down through the deck below, thus giving the radiation of unnecessary heat into the atmosphere. All ranges, both for passengers and crew, and the bakers' ovens are fired by oil, using the same fuel as the ship's boilers.

Among the items of apparatus fitted are steam jacketed stockpots of the tilting pattern, charcoal grills, steam ovens, kitchen hot presses, and the following machines electrically driven:—Potato peelers, meat mincing machines, ice-cream machines, dough mixers and dish washers.

In the pantry are fitted hot presses and carving tables, with steaming shelves over, all of the most up-to-date design. The coffee apparatus is similar to that employed in the very best hotels. There are electric toasters and griddle plates.

The whole outfit has been thought out with the object of serving luxurious meals equal to anything obtained in the finest hotels in the world.

Kunishima Waterworks, Osaka



ANY towns and country districts in Japan possess waterworks equipped on modern lines, and one worthy of particular mention is the Kunishima Waterworks, of the Municipality of Osaka. The original scheme was to provide pumping sets delivering 450-500 cub. ft. or 600-700 cub. ft. per min. against a manometric

The testing arrangements conformed to the usual practice as laid down and approved for official tests.

The manometric head was ascertained by actual measurement of the suction head from the water level in the suction well to the middle of the delivery pressure gauge, and by measuring the pressure head by means of a control pressure gauge. The quan-

tity of water delivered was measured by a Venturi meter and the head adjusted by throttling for which purpose a gate valve was employed. The pumps were belt-driven by a 500-h.p. three-phase motor, the characteristic curve for which was obtained by a mechanical brake and electrical measurements. The power absorbed by the shafting and belting was ascertained by uncoupling each pump. Table 1 shows the test results of the first four pumps running at 1170 revs. per min.

All four pumps easily attained the



OSAKA MUNICIPAL WATERWORKS, JAPAN

12 Centrifugal Pumps, delivering 45,500 galls. per min., against a head of 180 ft.

guaranteed efficiency of 80 per cent. and in some cases exceeded it by 1 or 2 per cent. The quantity of water delivered by the pumps and the heads against which they could work also proved to be somewhat greater than what had been anticipated from the calculations and tests made with pumps already built on similar lines.

The official trials at Osaka after the pumps were installed, were carried out under the supervision of Professors of the Osaka Technical College appointed at the request of the Municipality.

All twelve pumps were tested on site and the results of some of these tests are given in Table 2. When these results are compared with those obtained at Winterthur, it will be seen that they confirm that the efficiency of the pumps exceeds 80 per cent.

Table 1.

	Guaranteed	Tests							
Delivery, cub. ft. p. min. ...	600	594	755	596	600	615	716		
Suction Head, ft. mano ...		10.5	10.5	10.2	10.2	10.2	10.5		
Delivery Head, ft. mano ...		186.3	170.8	186.0	189.3	196.8	177.8		
Total Head, ft. ...	180	196.8	181.3	196.2	199.5	207.0	188.2		
Revs. per min. ...	1170	1178	1162	1160	1168	1167	1165		
H.P. at motor shaft ...		289	339	289	299	304	339		
H.P. lost in shafting and belting ...		16	16	16	16	16	16		
H. P. absorbed by pump ...	260	273	323	273	283	288	323		
Theoret. H.P. of pump in water raised		255	264	225	230	245	259.5		
Efficiency of the pump % ...	80	82.5	81.7	82.5	81.3	80.6	80.3		

(Continued on page 720)

head of 200-ft., but after further consideration of all matters, it was finally decided to install sets delivering 600 cub. ft. per min. against a manometric head of 180-ft.

The following is an extract from the specification issued to the firms invited to tender for the work:—

"The pumping machines required are, in all, twelve in number, each machine consisting of a centrifugal pump direct coupled to a three-phase induction motor of high efficiency. Each pump should be capable of lifting filtered fresh water at a steady and

continuous rate of at least 600 cubic ft. per min. against a total manometric head of 180-ft. The water level in the suction well is expected to fluctuate from 4-ft. to 14-ft. below the floor level. Every pump should be capable of sucking up water from the suction well, through the strainer, foot valve and suction piping, against any suction head within this range. If oil be used for lubrication of the stuffing boxes or glands in the walls, or covers of the casing through which the shaft passes, some means should be provided for preventing it from entering the inside of the casing. The masses of the revolving parts should be perfectly balanced, so that there is no vibration or noise when the pump is running at any speed attained. The casing should be so designed and made, that the inside is easily accessible and the impeller and guide ring can easily be taken out whenever required. Every part of the pump should be designed and made with such strength and stiffness, that the machine can run continuously with safety, even when the load is 20 per cent. more than the normal."

The particulars given in the specification called for 12 Sulzer pumps, each delivering 600-cub. ft. per min. against a manometric head of 180-ft. and running at 1,170 revs. per min. to correspond to the periodicity of the three-phase supply which is 60 cycles.

The interior of the completed pumping station is shown above. The pumps are of the single-stage high-lift centrifugal type with guide rings and constructed to a special design.

The twelve pumps were submitted to specified tests, in batches of four, these tests being carried out at Winterthur before despatch.

Proposed Train-Ferry Schemes for Nanking-Pukow and Wuchang-Hankow

By P. H. Chen.

IT is well known to the traveling public that the most inconvenient part of the journey between Shanghai and Peking is to take the ferry boat between Nanking and Pukow. All the passengers have to get off at Nanking, look after their baggage, and wait for the ferry. On fine days, such accommodation is already unpleasant enough, but on inclement days, which are not uncommon in that section of the country, the conditions are indeed intolerable. Moreover, in order to arrange the train schedule for crossing the Yangtze River in daylight, trains must pass the bandit-infested districts in Shantung at midnight, and this, to a certain extent, was also responsible for the unfortunate Lincheng incident.

Not only passengers have experienced inconveniences and hardships, but the goods traffic has also suffered from poor economy and poor efficiency. At one end of the ferry, all the goods must be unloaded from the trains, loaded on the small boats, unloaded again from the boats and reloaded on the trains at the other end. The handling charges for a 40-ton carload across the Yangtze River have been as high as thirty dollars. Again, in rough weather, small boats have to stop operation, and consequently many cars which otherwise could be used to good advantage have to lie idle. And furthermore, on account of the lack of adequate accommodation, south bound trains from Lunghai Railway are restricted to only one train a day.

That there is a need for improvement of the trans-river service between Nanking and Pukow has been a long past conclusion. One reason why the attention has been neglected is that there have been some people who strongly oppose having the service improved, simply because they have a pet wish to see Pukow developed into a great center of commerce, one to take the place of Shanghai, or one at least equal to Shanghai. It is a matter of fact that, when compared with Shanghai, Pukow would be a better port, as it is very much farther inland while at the same time it has an adequate depth of water to accommodate the biggest ocean liner. Now these people maintain that the improvement of the transportation service between Nanking and Pukow would hinder such a development as desired. But they seem to ignore the fact that the possibility they see is still something in the future while the inconveniences and hardships are actual daily occurrences. Fortunately there is a growing number of other people, who while not unaware of the possibility of Pukow as a commercial center, still see the urgency of the need of improving the service.

During the past years, many schemes for solving the problem were proposed by dif-

ferent engineers. Some advocated that a bridge should be built while others offered plans for a tunnel. But such proposals did not seem to have come from those who had actually investigated the site in detail. The present channel is 3,800 feet wide and 154 feet deep at low water. And further, it is by no means a fixed channel; it may possibly be shifted to Pucheng in the future. With unusual depth of water, swift current, and wide, shifting channel, it is beyond one's comprehension to have a bridge built at this site at moderate cost, and for the same reason it is also out of the question to build a tunnel with long approaches.

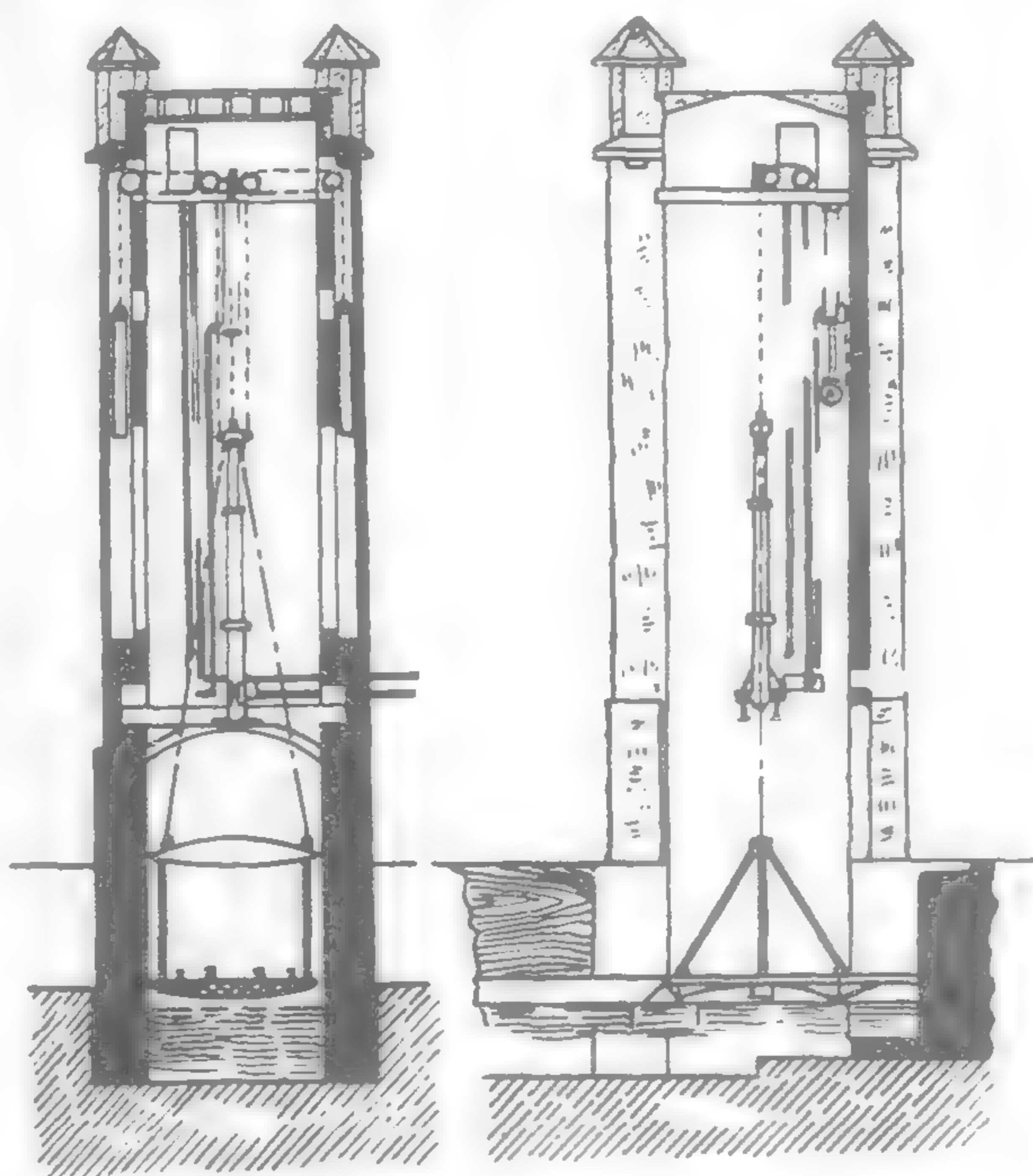
More recently other engineers have proposed the use of train-ferries, of which three different designs have been brought to notice. They are: 1. Train-ferry with a lifting deck; 2. Train-ferry with a vertical lifting device on shore; and 3. Train-ferry with a fixed incline on shore and a triangular movable gangway.

1. The train-ferry with a lifting deck is used in Europe and America only at places where the differences of water levels are small. The deck can be raised or lowered to suit the different levels and usually wire ropes are used for loading and unloading. This type of train-ferry has been very strongly recommended for Nanking and Pukow and details have already been worked out by some British firms, with an estimate of costs as follows:

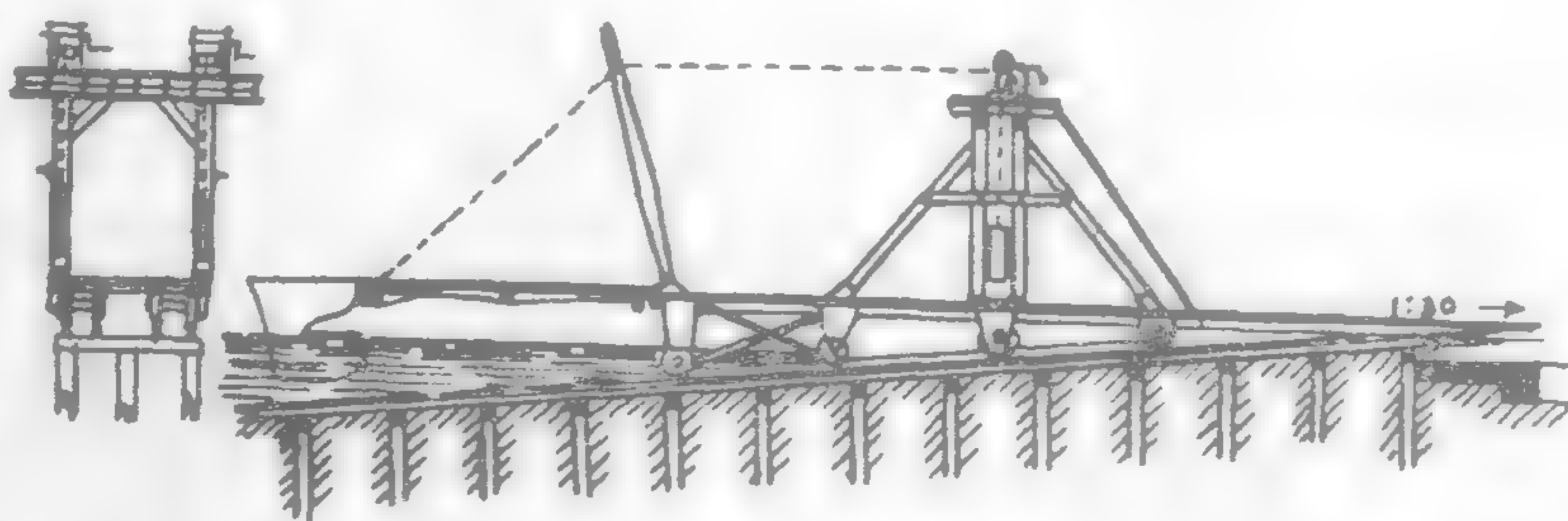
Piling and decking for wharves and jetties, approaches, moorings, earth work, etc.	\$1,500,000
Train-ferries	4,100,000
Total	\$5,600,000
Land to be acquired ..	1,250,000
Grand total	\$6,850,000

In the first place this design is too costly and in the second place it is not practicable. In case of a heavy storm, it is exceedingly dangerous to have trains crossing the river some forty feet above the water level. Even in fine weather, it would have a great deal of psychological effect, on passengers riding at a dizzy height. If the deck is to be lowered and raised each time it is used, it will require too much time and expense. Moreover, such a ferry gets out of order easily and therefore needs too much care.

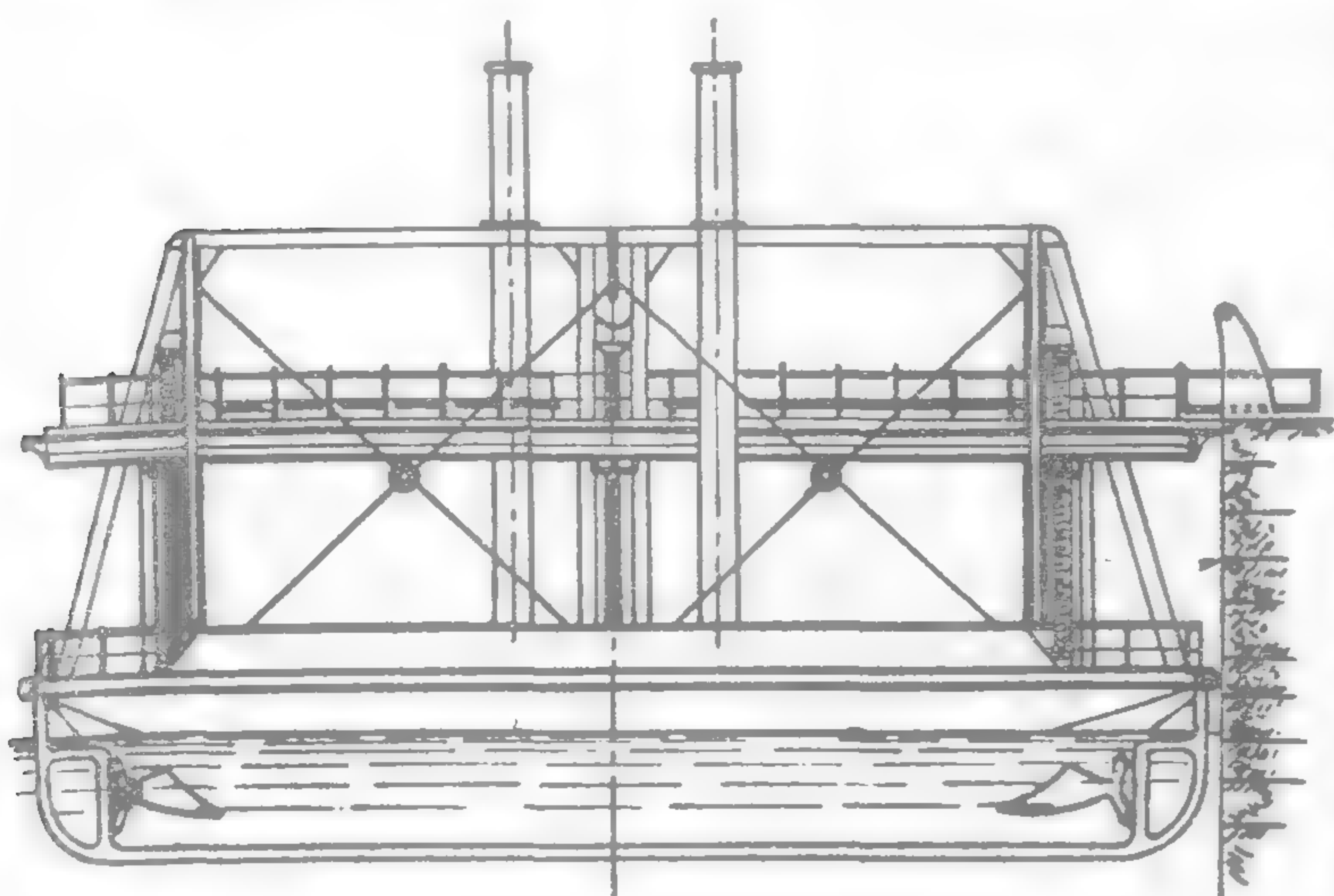
2. The train-ferry with the vertical lift on shore is common in Europe. The train has to be lowered every time to the level of the ferry and raised up again after crossing the river. Such a scheme requires too much mechanical operation. Nor does it seem economical to install powerful machines with a power house which is used only a few hours a day. Besides, they are easily out of order and the maintenance expense will be consequently very high.



TRAIN-FERRY WITH A VERTICAL DEVICE ON SHORE.



A TRIANGULAR MOVABLE GANGWAY



TRAIN-FERRY WITH A LIFTING DECK

3. The train-ferry with a fixed incline and a triangular gangway is also being used in Europe and America. The gangway moves along the incline to suit the ferry. But one trouble with this scheme is that a part of the incline is under water all the time, so that in case there is something the matter with the structure, it is very difficult to repair. And further, the mooring place changes with the water level, and it is rather expensive to build a wharf of the right kind.

The schemes and designs mentioned above have been carefully studied and all have been found wanting so far as it concerns their

being applicable to the crossing of the Yangtze River between Nanking and Pukow, and therefore in their place the writer wishes to propose in the following paragraphs a new train-ferry scheme, which is at once simple in construction, easy to operate, and cheap to build and maintain.

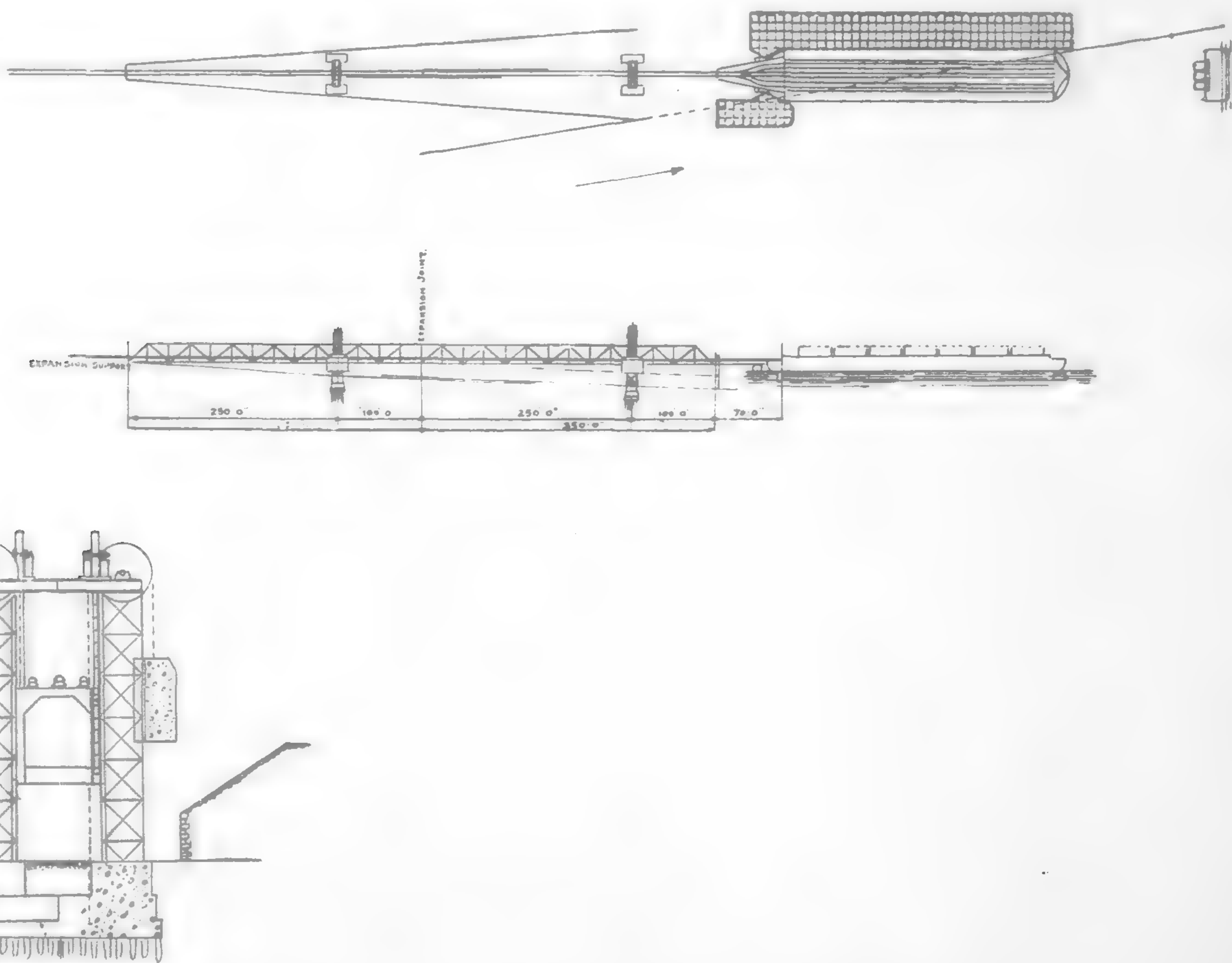
The new scheme is a train-ferry with a movable incline. The details are explained as follows:

1. *Ferry boat.* An ordinary ferry boat with three or four tracks on deck may be used. There is no special equipment on the ferry; it may be operated either by its own power or by a tug boat. The construction is therefore very simple.

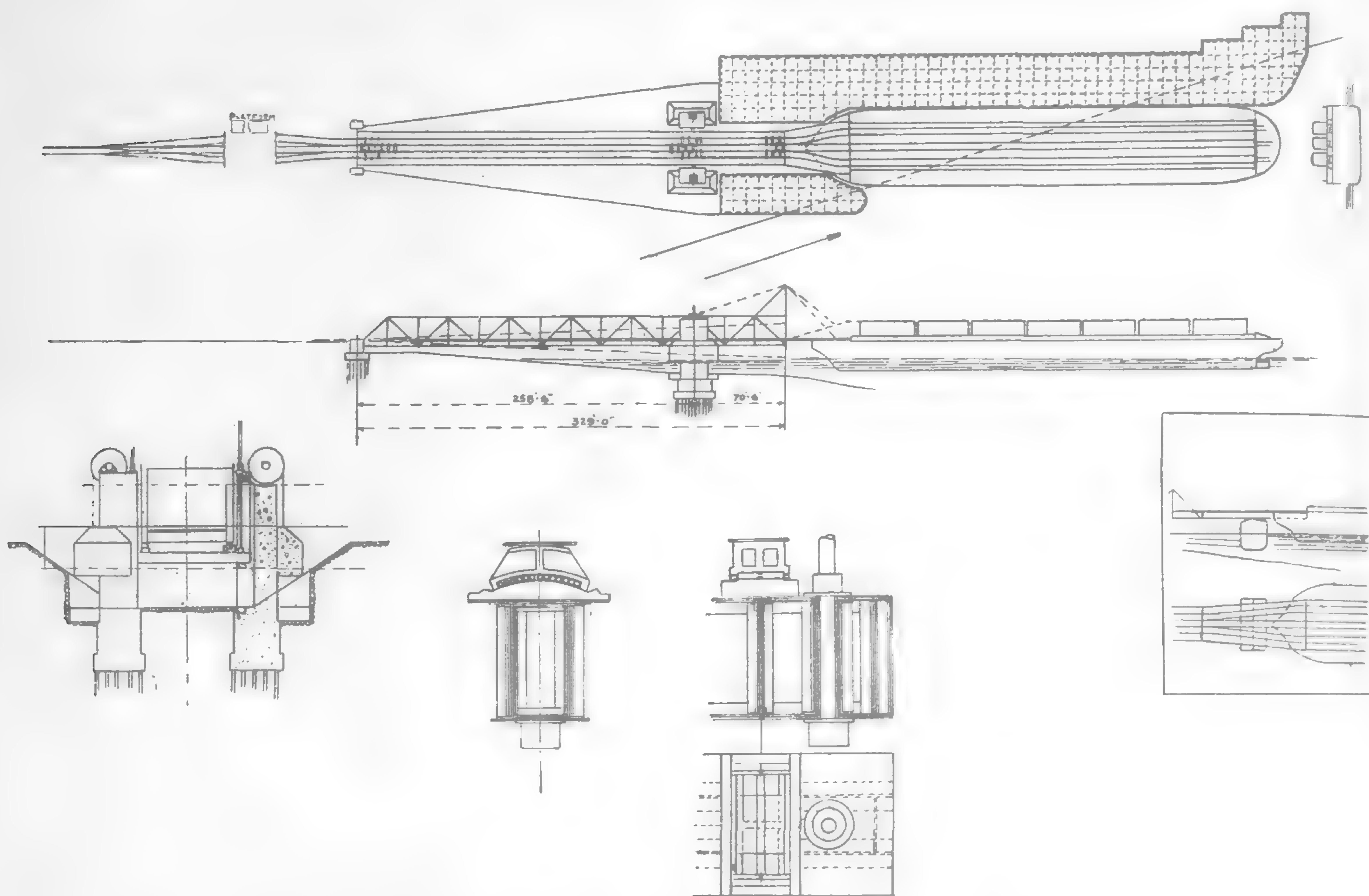
2. *Movable incline.* This is made in the form of a steel bridge, one end of which is hinged and the other end can be lifted by means of big screws resting on piers. The dead load is counter-balanced by counter-weights, the same as vertical lifting bridges. If there is no change in water level, it will remain in position. It is provided with a floating gangway, which by means of its change of slope, will take care of slight variations. This bridge can be raised or lowered either by an electric motor or by hand power, as the dead load is already counter-balanced.

3. *Loading and unloading trains* is done by a shunting locomotive with racks. The weight of the locomotive should not exceed the weight of the heaviest freight car, so that the locomotive can go on the ferry whenever necessary. Rack locomotives are the same as ordinary shunting engines, except with gears to work on racks. In this way, the tractive force on the incline does not depend upon the friction on rails, which renders the locomotive very safe on high grades. On level tracks, however, they will take the place of ordinary shunting engines.

4. *Grade.* With rack locomotives, a 4 per cent. grade will be safe for the incline. This is more so, as the deepest grade occurs only once a year within only a short period. To change to a lighter



PLAN OF TRAIN-FERRY BETWEEN HANKOW & WUCHANG



PLAN OF TRAIN-FERRY BETWEEN HSIKWAN & PUKOW

grade will slightly increase the construction cost. Such details can be decided upon when the scheme is adopted.

5. *The wharf* is to be at an angle with shore line so as to reduce construction work in the river, and with the further advantage that it will not have the danger of scouring and possible damage by boats. There will be occasional dredgings to maintain a sufficient depth of water for the train-ferry.

6. *The location of the wharf* should be in front of the present station. Back shunting on both stations should be avoided by using curved platforms. On the Hsiakwan side, the train should enter the Nanking station at a curved platform and then directly go to the wharf without back shunting. The writer has personally visited these places and found such could be done without incurring excessive expenses.

7. *Train.* The track on shore is to be at the level of the highest water level. No part of the track will then be under water at any stage. The track on the ferry is twelve feet above the water level. The movable incline will be able to rise twelve feet and descend thirteen feet, which is equal to the maximum difference of high and low water levels.

8. *Estimate.* The train-ferry will cost approximately \$600,000 each; the movable inclines, about \$650,000; the wharves, about \$700,000; and miscellaneous expenses, \$200,000. The total cost is about \$2,750,000, exclusive of land required.

To have a train-ferry service for Wuchang-Hankow is even more difficult than to have one for Nanking-Pukow, because at Wuchang-Hankow the difference between the high and low water levels is nearly fifty feet. Although it is not impossible to build a bridge across the Yangtze River at this locality, yet the train-ferry is cheaper and for years to come will be able to handle economically the traffic of the present growth.

The proposed design for a train-ferry between Wuchang-Hankow is somewhat different from the one that is for Nanking-Pukow and the differences are as follows:

1. There will be only one track on the movable incline instead of three, and one special three-way switch on the floating gangway. The reason for this modification is to reduce the weight of the bridge which has to be rather long.

2. In order to compute stresses more definitely the towers are to be made of steel which may be encased in concrete to prevent rusting.

3. The expansion support is not on the tower. The bridge is definitely fixed horizontally at this point. The towers are designed to take the thrust.

4. The raising or lowering of the bridge is similar to the vertical lift bridges, that is, by the pulling of ropes, instead of turning the big screws.

5. The live load is taken by the built-up member of the structure with a number of pin holes every three feet apart. The bridge will be hinged for every three feet of difference in elevation. For finer adjustments, however, the hinge on the overhead girder is resting on an oil cushion, similar to a water jack. The oil runs in while the hinge is raised and is automatically cut off when the hinge is lowered. In this way, the bridge can be adjusted to any elevation of a slight degree.

6. The incline will be 700 feet long to be divided into two sections, or if preferred, it may be 1,000 feet long and divided into three sections, each of which can be easily raised or lowered. If the difference in water levels is about ten feet, only the section next to the river is to be raised or lowered, and the other sections are to be moved only for greater differences in water levels, say twenty feet and above.

The Sibalom River Irrigation System

Antique Province, Philippines

From the Chief Irrigation Engineer's Report, June, 1924

THE project takes water from the south bank of the Tipuluan River and conveys same through a short main canal and a tunnel 128 metres long to the lands to be irrigated. The area of the irrigable district is 3,500 hectares located in the municipalities of Sibalom and San Jose of Antique Province in Panay Island. The land to be served by the proposed system is all under cultivation and is shown on the accompanying map.

San Jose, one of the two towns to be benefited, is the capital of the province and an automobile road connects it with the town of Sibalom. Small steamers provide a weekly service between San Jose and Iloilo, the third largest port in the Philippines. A road to connect these towns is well under way and will greatly improve market facilities when completed.

The entire area under the project is devoted to growing one crop of rice a year, but it is actually producing a very low yield.



The Sibalom Irrigation Project

The need for irrigation in this district has been recognized for many years as indicated by numerous resolutions received from time to time from the interested municipal councils and the Provincial Board of Antique. Crop failures or partial failures have been frequently reported during the past twenty years. Rainfall hydrographs of this district show that the rainfall is not adequately distributed to mature a normal rice crop.

A very small area is used for growing dry season crops of corn, tobacco and vegetables. The production of palay should be increased to 50 or 60 cavanese per hectare, which is fully 50 per cent. more than the present average yield. The proposed system will also provide sufficient water for a second crop of rice on the entire area under the projects.

The land has good natural drainage and placing it under irri-

gation will not necessitate the construction of artificial drains. The construction of a dyke bordering the main canal will prevent the inundation of the land by the Sibalom River and the loss of crops due to floods.

Gaging stations have been maintained on both the Tipuluan and Sibalom rivers covering a period of about 3 years and the records show that there is an adequate water supply for growing two rice crops a year on the land included under the proposed system. There are no existing water rights to interfere with the success of the project.

Irrigation Plan

The system, as planned, consists of a permanent headgate structure to draw water from the natural level of the river except during extreme low water when a temporary brush dam may be used to raise the water. Should changes occur in the river channel making it difficult to divert water without a dam during the rainy season, a low weir with falling shutters may be constructed at a comparatively small cost to regulate the flow in the main canal. The canal system includes 3.2 kilometres of main canal and approximately 50 kilometres of lateral canals. On the river side of the main canal, north of the town of Sibalom and also above the tunnel a dyke approximately 2 kilometres long and 2 metres high has been constructed, as indicated on the map of the project, to prevent the river from flooding the town of Sibalom and the land included under the system.

The construction of this project without a diversion weir involves no engineering difficulties and in case it should be necessary later on to build a weir, the diversion site selected is the best available site for the construction of a permanent weir. The construction of the canal system involves approximately 150,000 cubic metres of earthwork and the building of the usual canal structures to regulate the flow of water in the system and to provide drainage and road crossings.

The estimated cost of construction without a diversion weir is as follows:

Headworks	P. 28,000.00
Earthwork	125,000.00
Canal Structures.. ..	110,000.00
Right of way	1,000,000

P.273,000.00

Engineering, 9% 24,570.00

Total P.297,570.00

Say 300,000.00

The construction of the diversion weir is estimated to cost about P.250,000.00.

On the assumption that the system will be constructed without a weir to irrigate 3,500 hectares of land, the estimated cost per hectare is P.85.70. The equal annual installments to be paid in 20 years on the basis of the above cost of P.85.70 per hectare will be P.10.73 per hectare which consists of the following items: Construction charge, P.4.285; interest charge, P.3.73; estimated operation and maintenance charge, P.2.50; and insurance which is 2 per cent. of the preceding items, P.0.21.

The following reasons were advanced in recommending the construction of the project to the Secretary of Commerce and Communications of the Philippine Cabinet; (1) The rice crop will be insured on the largest tract of available rice land in Antique Province; (2) the land is all under cultivation and a sufficient water supply is available for growing two crops a year; (3) the crops produced will find a ready market in Iloilo and Occidental Provinces; (4) the production of rice will be increased in one of the most populous districts of Antique Province; (5) the recent crop losses caused by droughts and floods will be prevented; and (6) the cost of construction is low.

Construction work was started when the

contract for the excavation of the entire canal system was awarded early this year to Mr. A. G. Yankey, a local contractor. The construction of canal structures was awarded to Mr. S. Nagayue, a Japanese contractor. Construction work is scheduled to be completed before the beginning of the rice growing season of 1925.

Kunishima Waterworks, Osaka

(Continued from page 715.)

	Guaranteed	Table 2.								
		Test No.								
		1	2	3	4	5	6	7	8	9
Load, approx ...		1/2	3/4	7/8	4/4	9/8	4/4	5/4	4/4	0
Delivery, cub. ft. per min ...	600	240.4	465.9	532.1	610.3	681.3	613.7	769.1	612	0
Delivery Head, ft. mano ...		192	192	188.7	185.5	177.6	185	163	177.5	172.5
Suction Head, ft. mano ...		7.9	7.9	8.1	8.4	8.9	9.1	9.6	14.8	14.7
Total Head, ft. mano ...	180	199.9	199.9	196.8	193.9	196.5	194.1	172.6	192.3	187.2
Revs. per min ...	1170	1200	1185	1180	1175	1170	1175	1175	1180	1190
Motor input in K.W.		128	186	202	222	241.2	224.8	262.4	223.2	90
Net power in K.W.		67.9	131.7	148	167.3	179.6	168.4	187.6	165.4	
Combined efficiency ... per cent.		74.5	53.04	70.79	73.27	75.34	74.32	74.9	71.5	74.1

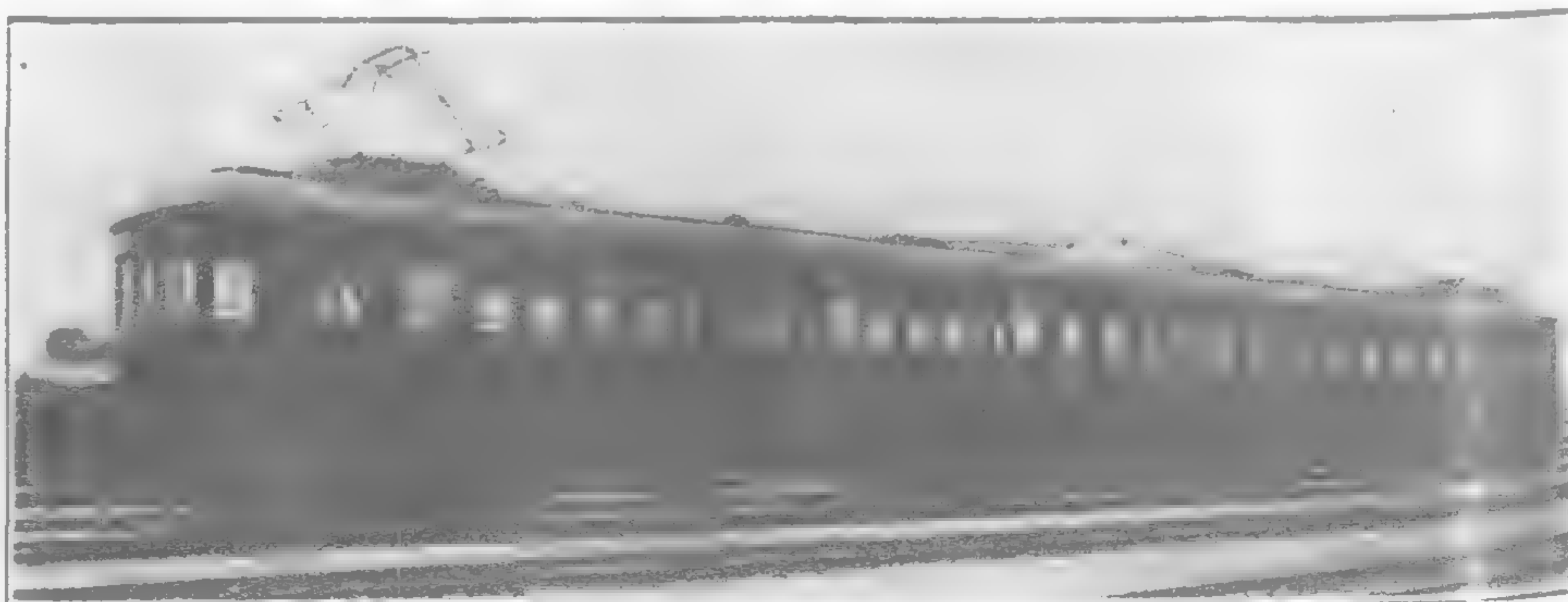


Brill Equipment for Japan.—Typical high-speed interurban Brill No. 27-MCB2 Truck furnished to the Hanshin Express Electric Railway, one of the leading interurban systems of Japan. Equipped with 33-in. diameter steel tired wheels, 4½ by 8-in. M.C.B. journals, and having 6-ft. 6-in. wheel base

Brill Equipment for Japan

ANOTHER illustration of the world-wide activity of Brill Equipment in the field of transportation is to be found in a shipment made a few months ago to the Hanshin Express Electric Railway, Japan. It consisted of twenty No. 27-MCB2 Trucks, 6-ft. 6-in. wheel base, equipped with 33-in. steel wheels and 4½ by 8-in. M.C.B. journals, and ten carsets of platform hand brakes and body brake rigging.

The Hanshin Express Electric Railway is one of the leading interurban railway systems in Japan. It already had in its service numerous other Brill Trucks, and this recent shipment is an indication that their service has measured up to the high standard for which Brill Trucks are known.



Brill Equipment for Japan.—Brill 27-MCB Trucks in service on lines of Hanshin Express Electric Railway

New P. & O. liner *Chitral* on its recent trials

New P. & O. Liner—"Chitral"

BUILT and engined by Messrs. Alexander Stephen & Sons, Ltd., Linthouse, Glasgow, the *Chitral* was completed and delivered to the Peninsular and Oriental Steam Navigation Company on June 12, and is scheduled to make her maiden trip to Australia on July 3. This will enable the company to maintain an uninterrupted fortnightly service as she will run in conjunction with nine other vessels.

The principal dimensions of the *Chitral* are :—

Length overall	..	..	..	574 feet
Length b.p.	..	..	..	524 feet 7 inches
Breadth, moulded	..	..	..	70 feet
Depth, moulded to shelter deck	..	..	..	46 feet
Draft	..	..	..	30 feet 3 inches
Displacement	..	..	..	22,400 tons
Deadweight	..	..	..	11,000 tons
Gross tonnage	..	..	..	15,248 tons
Speed at sea	..	..	..	16 knots
Indicated horse power	..	..	..	11,000

The vessel has nine watertight bulkheads and six main cargo holds, with a total capacity of 600,000 cubic feet. Holds Nos. 2, 3, and 4, immediately adjacent to the machinery spaces have a capacity of about 300,000 cubic feet, and are insulated for the carriage of meat and fruit, the meat being refrigerated by the usual cold brine grids, and the fruit cooled by a system of motor fans and air trunks. In addition to the refrigerated cargo spaces the ships provision rooms are also insulated and refrigerated. The refrigerating plant is supplied by J. and E. Hall Ltd., Dartford, and the insulation has been carried out by Livingston & Co., Ltd. Glasgow.

The extensive mail and parcels rooms are arranged for sorting the mail bags during the voyage, as the vessel will deliver and receive mails at all her ports of call.

The cargo-handling appliances are designed on the union purchase system to deliver cargo simultaneously on both sides of the ship. Each hatch is, therefore, fitted with four winches, there being twenty-two 3-ton and four 5-ton Laurence Scott electric winches. The derricks are of tubular steel, and a 40-ton derrick has been fitted and tested under load at the foremast to take the occasional heavy cargo in No. 2 hold.

The number of passengers has been strictly limited—203 first and 103 second saloon passengers—in order to provide the greatest possible number of single berth state rooms. The remaining rooms have two berths, and some 18 rooms have folding upper berths for use when desired, these being the only upper berths in the passenger accommodation.

Every cabin has a porthole and an electric heater, and the furniture includes dressing table and drawers, wardrobe and wash-basin for each passenger, besides numerous hooks, hangers, and other gadgets.

There are de luxe and special suites with separate bath-rooms for 24 passengers, these rooms being specially decorated with hardwood or enamelled panelling. Baths are provided on an ample scale, and the ladies lavatories are fitted with electric irons and other appliances.

The first class lounge, music room and smoking room are situated amidships on the bridge deck. The lounge is in the 18th century style, and panelled in beautifully finished French walnut, with a fireplace of carved marble as the central feature of the room. The plaster ceiling is also noteworthy. The carpets are Persian in fawn and green, and the varied tapestry coverings to the walnut furniture give a very rich but subdued effect.

The music room is panelled in the Adam style. The walls are finished in green and ivory, with the delicate enrichments scrubbed. The raised roof rises to a height of 16 feet, with a circular cupola in wrought iron. The enriched plaster ceilings are particularly successful, the whole room giving a feeling of height and dignity. The floor, which is intended for dancing, is inlaid with oak parquetry. The furniture is a rich mahogany, and the coverings in green silk damasks are in harmony with the walls.

The smoking room is panelled in a bleached British oak and treated after the manner of the Gothic craftsmen of the 15th century. The varied carvings in this room are full of interest, and with the fine stone chimney piece and the ingle nook make this room peculiarly quaint and pleasing. There is a very fine laylight in the half timbered dome with leaded glass panels showing the armorial bearings of the ports of call of the ship. The furniture is oak and the coverings antique hide with occasional pieces covered in tapestry. The aft end of the smoking room opens into a verandah simply treasted with plaster panels and fitted with Dryad cane furniture.

The first class dining room is on the upper deck and extends the full width of the ship. The treatment here is based on the style of about 1750, the color scheme being of buff and blue. The rich blue Scagliola columns are very attractive. The mahogany furniture consists of restaurant tables for two or more passengers with the chairs covered in blue to harmonize with the curtains and coloring.

The first class entrance on the bridge deck is noteworthy. The design is of the 18th century somewhat similar to the lounge. The walls are finished in cool ivory with the carvings scrubbed, and an unique feature is the introduction of an old fashioned

grandfather clock, placed in an alcove at the after end. The first staircase is mahogany with a fine wrought iron balustrade.

The second dining saloon is further aft on the same deck, and is of a simple Georgian design with ivory walls, the enrichments being scrubbed. The furniture here is dark oak. The second music room and smoking room are situated at the after end of the shelter deck. The smoking room is a simple and cosy room, panelled in a rich brown oak, Scotch in treatment. There is a red rubber floor here laid in the form of a brick floor. The music room is panelled in the English Empire style and finished in two shades of grey. The color tones are rose and grey. The furniture is Sheraton and in mahogany. The whole of the public rooms were designed by the builders. The work was carried out by Waring & Gillow, Ltd., London, under the untiring supervision of the Hon. Elsie Mackay, daughter of Lord Inchcape, chairman of the P. & O. company.

The most noteworthy of the auxiliary details of the ship is the punkah louver system of ventilation by the Thermotank Company. Fresh air is supplied to both passenger and crew quarters, with exhaust systems from all galleys, pantries, lavatories, etc. The supply trunks are so arranged that not only every room but every berth receives a separate supply of fresh air through the punkah louvers, which may be directed wherever each passenger may desire. The air is delivered from motor fans on the boat deck, the inlets being covered with mosquito proof netting.

Among other fittings may be mentioned the open air swimming bath and the laundry, fitted with a complete installation of motor-driven washers, ironers, driers, etc., also the oil fired cooking apparatus by J. Phillips & Co., Glasgow, and the milk machine to supply impeccable fresh milk and ice cream at any time and in any climate.

The safety appliances include twelve sets of MacLachlan gravity davits which enable one man to handle without effort any of the eleven 29 feet lifeboats or the 30 feet motor lifeboat; a wireless installation and a wireless direction finder by the Radio Communication Co., Ltd.; a motor driven electric generator on the boat deck to give current in emergency for lighting the ship and working the lifeboats, the lift from the engine room and the large emergency pump; Stone-Lloyd watertight doors below the water line and fireproof divisions and doors on the accommodation.

The propelling machinery consists of two sets of balanced quadruple expansion engines having cylinders $29\frac{1}{2}$ inches, $42\frac{1}{2}$ inches, and $60\frac{1}{2}$ inches, and 67 inches diameter with a stroke of 54 inches, and are capable of developing 11,800 i.h.p. for a speed of 16 knots on service. Steam is supplied by four single-ended and three double-ended cylindrical boilers working at a pressure of 215 lbs., and burning oil fuel on the "Clyde" system, of which the builders are the sole licensees, with Howden's forced draught. The main propelling machinery and the auxiliary machinery throughout are of the highest class, and have been fitted with all the latest improvements in design.

The dynamos, by Shanks & Co., are five in number, to give current to the numerous electric fittings, winches, and fans throughout the ship. The windlass and four warping capstans forward and aft are driven by steam, as is the steering gear, the steam tiller type by Brown Bros., Edinburgh. Twelve sets of the MacLachlan automatic patent gravity davits are being supplied. Eleven sets handle the 29 feet lifeboats, while the twelfth handles the 30 feet motor life boat.

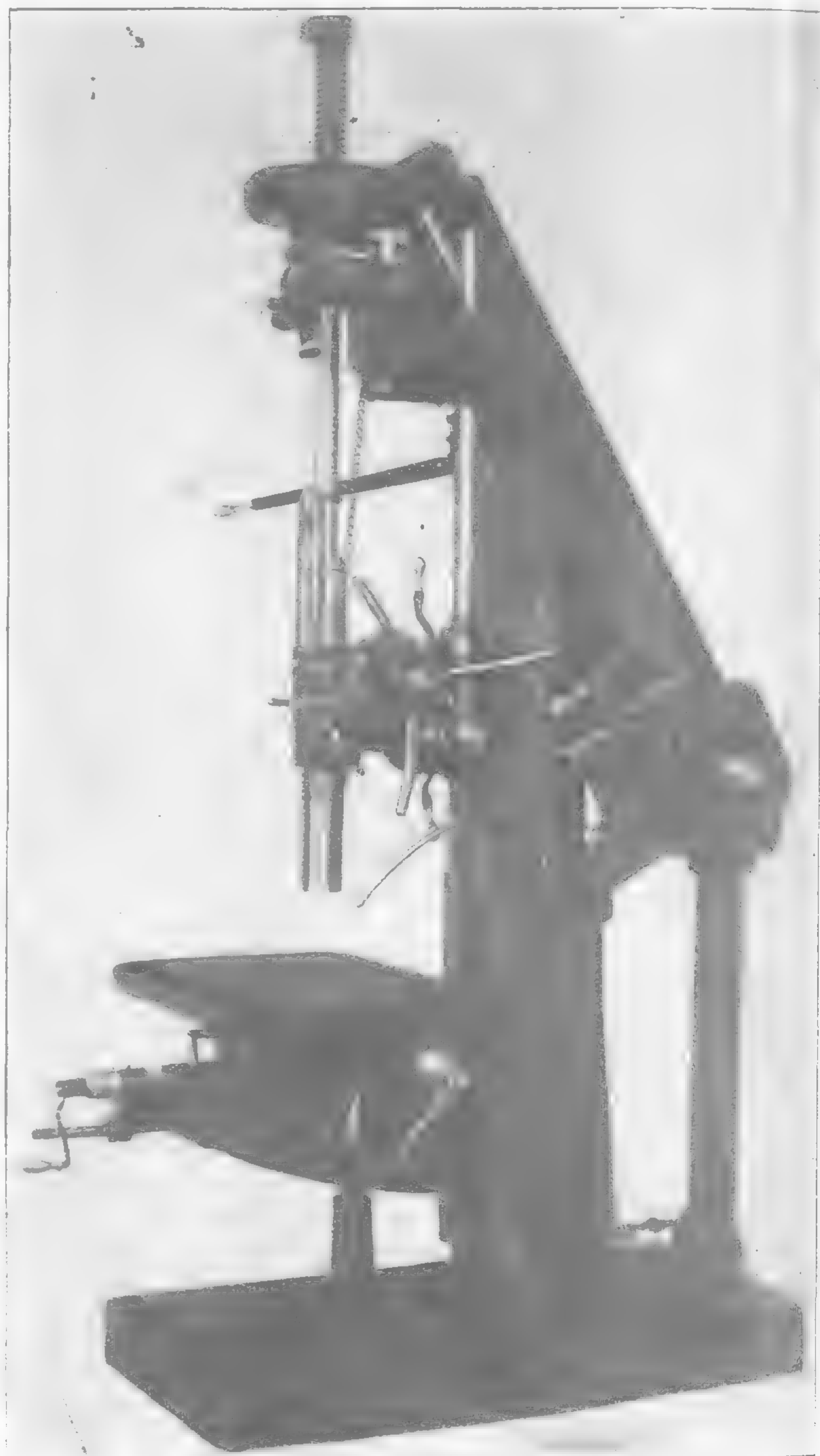
Self Oiled All Geared Sliding Head Drill and Tapper

WHAT is described as the very latest unit of "Self Oiled All Ball Bearing All Geared Drill" is here shown with compound table and special oil base having pumps on either side with oil well at the rear for the cutting coolant.

The pump shown, however, has nothing to do with the "Self Oiled System." The geared pump which takes care of the Self Oiling System is in the oil reservoir where the drive shaft is indicated at the foot of the backbone, and on which shaft will be seen pulley for driving the coolant pump.

This machine embodies all of the advantageous features of the All Geared construction, besides having a Sliding Head. It has thirteen radial ball bearings in addition to the spindle thrust bearing. The Self Oiling System automatically oils all bearings continuously. Friction is thus reduced, until with one finger, all shafts and spindles may be easily rotated.

There are available eight changes of geared speeds and eight changes of spur geared feeds, all under instant control from the front of the machine. The worm and worm gear with resulting wear are eliminated.



Self Oiled all Geared Sliding Head Drill and Tapper

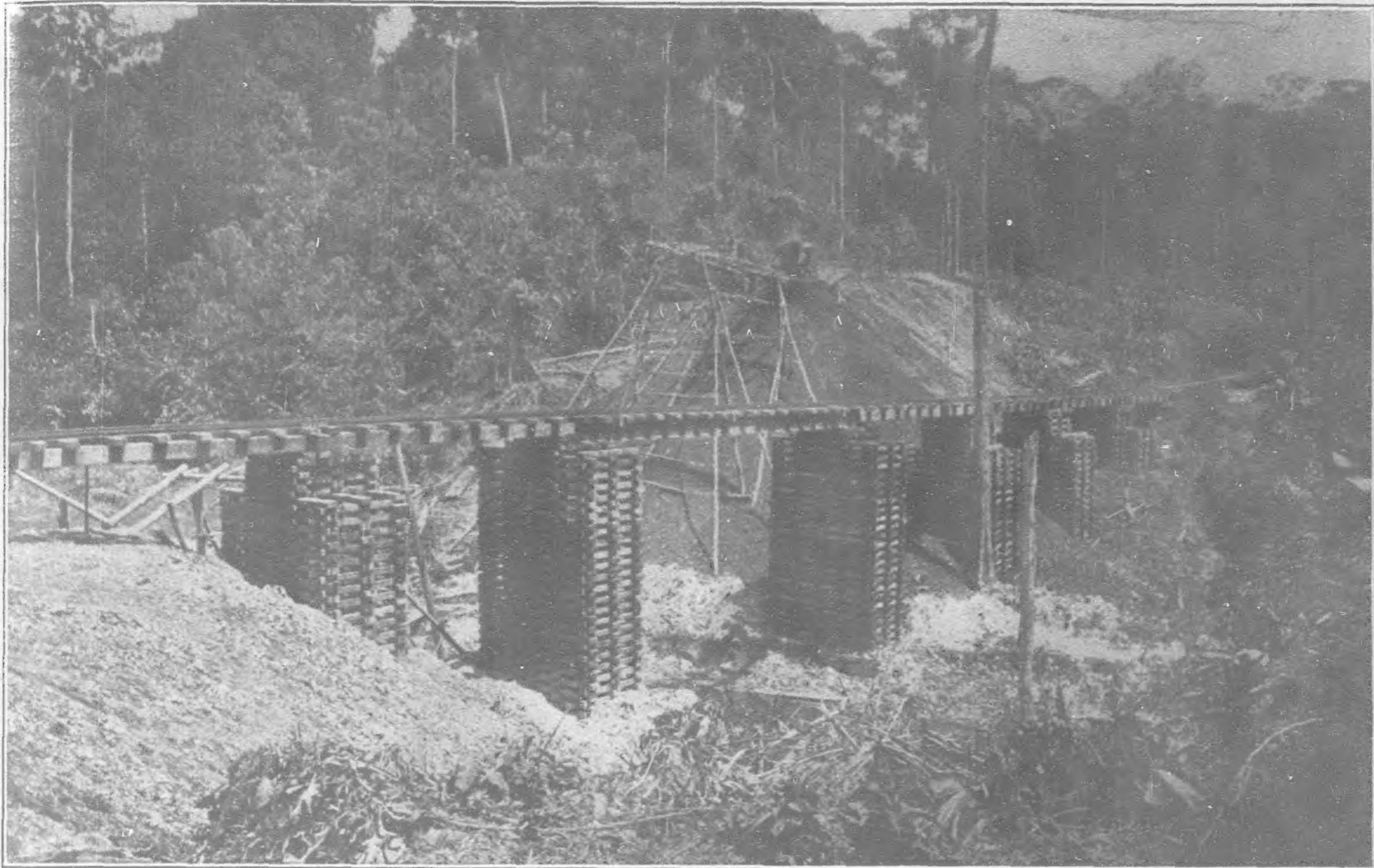
Observe Star Wheel Handle which operates thru Internal Gear in ratio of four to one. A great improvement over ordinary lever.

Dovetail method of attaching rack to sleeve is used. In this construction, key takes thrust. No screws are used.

All Gears are fully enclosed, meeting requirements of modern safety laws.

This super-production drill handles high speed twist drills up to 2-in. at suitable speeds and feeds. Bores an 8-in. hole in cast iron.

The drill is furnished with back gears, spur geared feeds and automatic stop complete.



Construction Cribs near the 168th Mile, East Coast Railway, Pahang Section

Construction Work on the F.M.S. Railways

THE total expenditure during 1924 on construction work and surveys of new lines in the Federated Malay States, Straits Settlements and Johore amounted to \$3,918,237 as compared with \$6,788,784 for the year 1923.

EAST COAST RAILWAY : KELANTAN SECTION.

This railway starts from Tumpat and proceeds southwards towards Kuala Lipis in Pahang, the distance from Tumpat to the Pahang-Kelantan boundary being 140½ miles.

The line from Tumpat to Tanah Merah (32 miles) was opened for traffic on July 1, 1915, and from Tanah Merah to Krai (20 miles 55 chains) on July 21, 1924.

The official opening of the "Guillemard Bridge" over the Kelantan River took place on July 19, 1924. This bridge which is the largest in the Peninsula and is situated about 35 miles from Tumpat was commenced in 1920. It is 2,166 feet long over all being composed of five clear spans of 250 feet and five spans of 150 feet. The height from the river bed to the under side of girders is 55 feet.

The quantity of concrete and brickwork in abutments and piers is about 20,000 cubic yards and the total weight of steel work in the girders is 2,776 tons.

Floods in January-March-November caused a certain amount of damage and delay. The rainfall for the year at Tanah Merah was 112.1 inches.

Earthwork between Tanah Merah and Kuala Pergau excavated during the year was 569,753 cubic yards of earth and 118,247 cubic yards of rock for main line ; 21,823 cubic yards of earth and 2,258

cubic yards of rock in stream diversions ; 93,685 cubic yards in stations yards and 85,200 cubic yards were filled in at Tebbing Tinggi Bund.

Platelaying reached the 63rd mile from Tumpat southwards.

In addition to the Kelantan Bridge the following large bridges were completed during the year. Sungei Bedal Bridge, one span of 100 feet ; Sungei Nal Bridge, two spans of 100 feet and two of 250 feet ; Sungei Durian Bridge, one span of 150 feet ; Sungei Krai Bridge, two spans of 100 feet each. The main bridges now under construction are the Lebir Bridge, two spans of 250 feet and three of 100 feet each ; Pahi Bridge one span of 150 feet and two of 100 feet ; Sungei Chanih Bridge, one span of 100 feet and Sungei Pria Bridge, one span of 150 feet.

Stations and the necessary quarters were opened at Sungei Kusial, Temangan, Sungei Nal and Krai.

The headings of tunnels Nos. 1 and 2 at mile 69½ were driven through and good progress made towards lining. A decauville track was laid from Manek Urai (63 miles) to the entrance of the tunnel.

The expenditure during the year amounted to \$1,388,697.

EAST COAST RAILWAY : PAHANG SECTION.

The work beyond Chigar Perah, 163½ miles from Gemas, was recommenced in December, 1923.

Good progress was made on earthwork and jungle felling, some 247.97 acres of jungle being felled ; 361,325 cubic yards of earth and 116,164 cubic yards of rock being excavated on main line ; 27,341 cubic yards in stream diversions of which 4,472 cubic yards were rock ; 13,266 cubic yards of earthwork were done in station yards,



Well Sinking for Bridge over Lebir River, 63rd Mile, East Railway, Kelantan Section

temporary yards and sidings and 1,687 cubic yards removed on account of slips.

Platelaying was completed to 170 miles and $5\frac{1}{4}$ miles of track were lifted and packed.

Locomotive water supply tanks and pump house at Chigar Perah were in course of erection.

Work on the tunnel at 171st mile has been started.

All bridges from Chigar Perah, 165 $\frac{1}{2}$ mile to 171st mile, have been completed.

The expenditure during the year amounted to \$476,614.

NEW ENGINE, CARRIAGE SHED AND GOODS YARD, IPOH.

The work of metalling the Kuala Kangsar Road Deviation was almost completed at the end of the year and a considerable amount of excavation and filling was done in the new goods yard.

The expenditure during the year amounted to \$49,136.

KUALA KUBU DEVIATION.

This work, which was in progress at the end of 1923, was completed in July, and handed over to Open Lines on August 1, 1924.

Seventy-three thousand four hundred and eighty-four cubic yards of main line earthwork, one bridge of 150 feet span over the Selangor River and two (one of 40 feet and one of 60 feet span) over the Rasa River, together with station buildings, goods shed platform and loading dock and approach roads to the station and goods shed at Kuala Kubu Road were completed during the period.

The expenditure during the year amounted to \$15,114.

PORT SWETTENHAM DOUBLING.

Construction work on the new bridge near the existing Con-naught Bridge was started during May.

Plans have been completed and indents for steelwork and caissons sent to the Crown Agents.

Boring was carried out at six different places at the site of the new bridge, the average depth of the bores being 80 feet.

The expenditure during the year amounted to \$55,811.

DOUBLING LINE, BATU JUNCTION TO KUALA LUMPUR AND SUNGEI BESI.

The doubling work, which was suspended between Batu Junction and Kuala Lumpur in 1920 and between the Abattoirs and Sungei Besi in 1923, was reopened in January.

The double line was opened to traffic between the Abattoirs and Salak South Junction on August 1, and the new down main line between Salak South Junction and Sungei Besi was finished on November 19, the old main line between these points being regraded.

Steady progress was made on the Kuala Lumpur and Batu Junction Section, the heading through the tunnel being completed on November 1. Swettenham Road Bridge was completed and work was started on the Residency Road and Club Road Bridges.

The total amount of earthwork executed during the year was 80,397 cubic yards and 4,076 cubic yards of rock.

The expenditure during the year amounted to \$294,573.

CARRIAGE AND ENGINE SHEDS AND GOODS YARD, SEREQBAN.

The filling up of the locomotive and carriage yard sites was practically finished.

Contracts were let for the completion of the engine and carriage sheds.

All roads and fences in connection with this work have been handed over to Open Lines.

Pipe drains were put in hand; also sidings to the engine yard and are nearing completion.

The engine turntable was erected.

The expenditure during the year amounted to \$77,678.

CAUSEWAY ACROSS THE STRAITS OF JOHORE.

The Johore State Railway, leased to the Federated Malay States Railway System, was opened to traffic in the year 1909, and coincident with this opening a ferry service between Johore Bahru and Woodlands for purposes of carrying goods across the Straits was brought into use. Ferry boats carrying six goods wagons at a time for transshipment were also started.

It had been anticipated by the first General Manager of Railways, Mr. C. E. Spooner, C.M.G., that the time would not be far distant when the volume of traffic across the Straits would become so great that some means other than ferry boats would be required and it was his suggestion in 1904 that the Straits between Johore Bahru and Singapore Island should be bridged. After consideration of this and other schemes for a period of some years, Mr. W. Eyre Kenny, then Acting Colonial Engineer, Singapore, made the suggestion that a rubble causeway should be substituted for a



Tunnel at 69th Mile, East Coast Railway, Kelantan Section



Bridge over the Nal River, 48th Mile, East Coast Railway, Kelantan Section

bridge. After examination of all the suggestions, Messrs. Coode, Fitzmaurice, Wilson and Mitchell, Consulting Engineers, Westminster, were asked to prepare plans and estimates for the construction of a causeway.

These plans finally shewed a causeway, 60 feet wide on the top—carrying two tracks of railway and a 26 feet roadway—with a total length of 3,465 feet—the greatest depth crossing the Straits being 77 feet—and the average depth of water being 47 feet at low tide. Provision has been made at the Johore end of the causeway for the passing of small local craft by the provision of a lock, 510 feet long from end to end—which lock is provided with a double set of gates spaced 170 feet apart with a width inside the gates of 45 feet and outside 32 feet. This lock has been crossed by a Schiller roller bridge with three girders.

The total width of this bridge is 57 feet, carrying two lines of railway and a clear roadway of 24-ft. 6-in.—the lift bridge 570 tons in weight and the tide gates being operated electrically.

One million six hundred and forty-one thousand seven hundred and twelve cubic yards of granite were used in the construction of the causeway, the total cost of which was \$12½ millions approximately.

The roller bridge selected for the crossing of the lock is the only one of its type in this part of the world and it is believed that

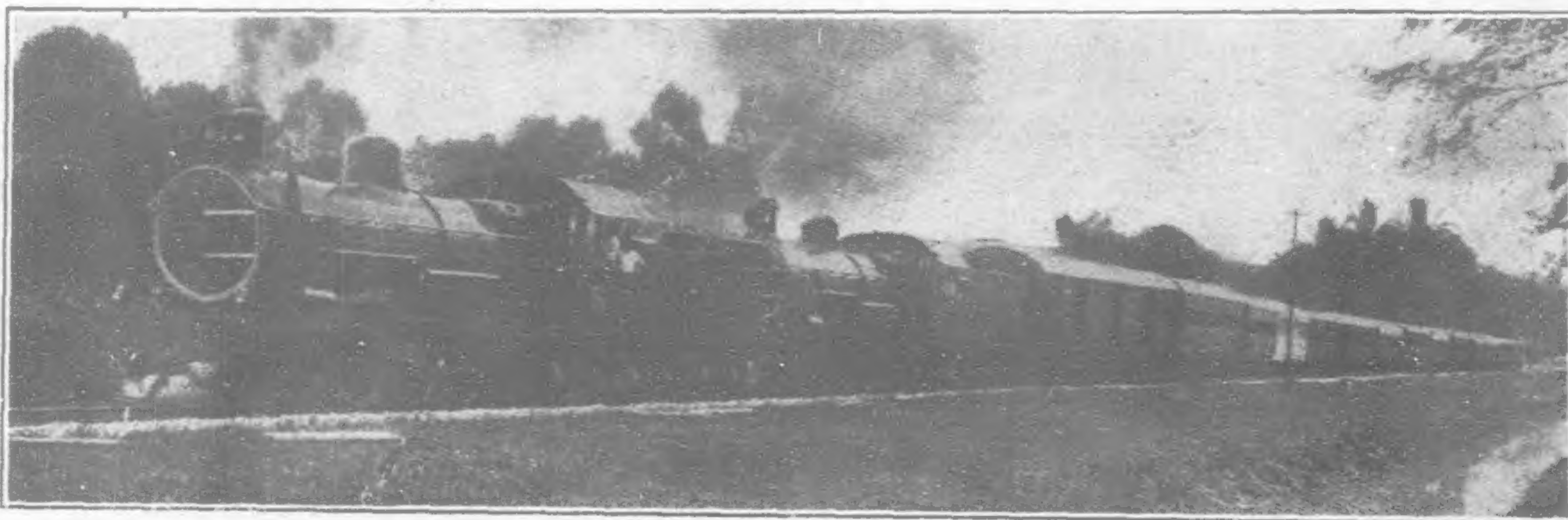
the causeway itself is the first work of this magnitude anywhere adopted.

The ceremonial opening was performed by His Excellency the Governor and High Commissioner in the presence of Their Highnesses the Sultan of Johore and the Rulers of the Federated Malay States, and the Chief Secretary to Government, Federated Malay States, on June 28, 1924, and the causeway has been in continual use from that date.

The result has greatly facilitated the working of railway transport; it has also tended very materially to increase motor transport as between Singapore and the mainland, and although the original idea for the construction of this causeway was enunciated by railway authorities for the purpose of facilitating its own transport and increasing its revenue, yet it cannot be wholly said that this has actually resulted, for the receipts between Johore Bahru and Singapore previously taken by the railway have been reduced by some \$5,000 a month, as a result.

Mr. P. A. Anthony, C.M.G., was General Manager and Chief Engineer of the Railways during the designing and constructing of the causeway and Messrs. Topham, Jones and Railton, London, were the contractors.

The expenditure during the year amounted to \$1,015,830.



Royal Special Conveying H.M. The King of Siam from Singapore on 29th September, 1924,
Drawn by F.M.S.R. Locomotives

Gold Mining in the Philippines

(Continued from page 699.)

Miscellaneous Districts

There are numerous localities where both lode and placer gold have been found in small quantities and where larger gold production might be looked for, but they cannot be handled under present conditions. These localities have all been referred to in various issues of Mineral Resources of the Philippine Islands.

Some of the more promising areas for prospecting, in my estimation, are the following: The mineral belt from Baguio north to the Pacific Ocean, lying a little to the east of Baguio and Bontoc and following very nearly the crest of the Cordillera Central (this belt is 10 to 15 kilometers wide and is largely due to granitic

intrusions); the cordillera of Camarines Norte south of Paracale; the main cordillera of Panay on the boundary of Antique Province; the eastern cordillera of Mindanao (Diwata Mountains).

It is more than likely that some good gold prospects may yet be located in Palawan, Mindoro, the Zamboanga Peninsula, and the eastern cordillera of Luzon, but I am not so sanguine about these regions as I am of those mentioned in previous pages.

The conditions affecting the welfare of this branch of mining in the Philippines are very much the same as those which have been discussed in connection with the industry in general. The most important needs at present seem to be capital, cheap power, more widespread interest, and a better price for gold; that is, lower cost of supplies, etc.

Production.—Figures showing the gold production for 1920 are given in Table 25.

The Need for Testing Materials of Construction used in the Far East

(Continued from page 703)

of the Government, included the following remarks in his statement:—

A systematic inspection of old retaining walls has been commenced. All the walls in the Taiping Shan District, together with many others situated on the lower and middle levels, have been already carefully surveyed; measurements and all other relevant data have been collected and conveniently tabulated for future reference and comparison. In several instances walls have been plumbed at intervals and diagramatic profiles plotted for further investigation. A similar inspection of walls in other districts of the city is at present in progress, and reports will be prepared as the necessary data are collected. Some of the walls already inspected are of very poor construction—considerably more so than the wall South of In Mi Lane, which collapsed in July*—and in certain instances the Public Works Department has already communicated with the owners—under powers bestowed by the Public Health and Buildings Ordinance—in reference to work which should be undertaken. No inspection, however careful, can of course provide against accident arising from disintegration below the foundations due to undetected subterranean water. After the completion of the systematic inspection now in hand, arrangements will be made for a quarterly return to be kept, giving particulars of any changes that may occur."

No doubt the general public in Hongkong will feel re-assured by this statement.

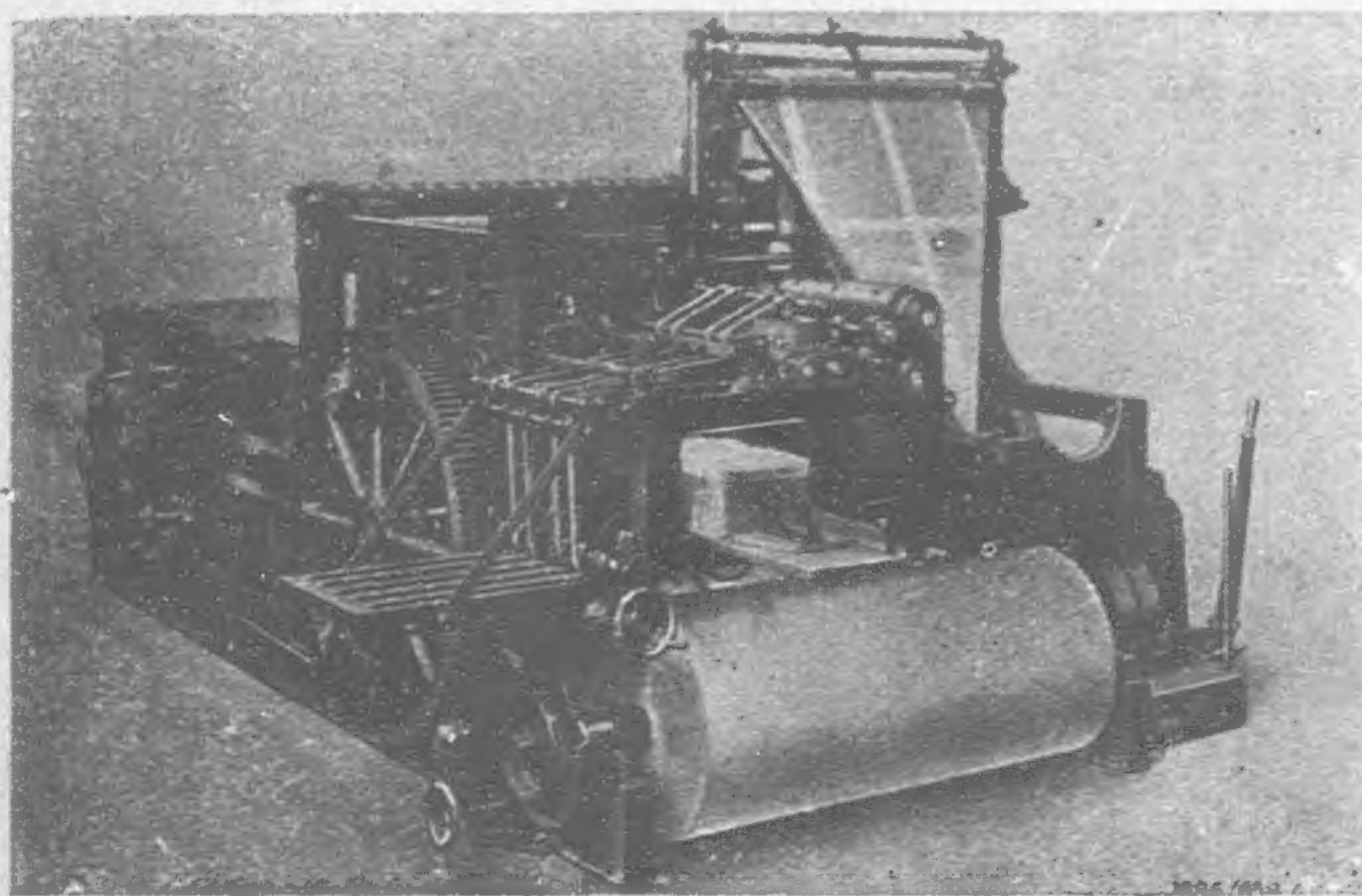
*Sometimes referred to as Po Hing Fong.

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